BRASS WORLD
AND
PLATING — POLISHING — FINISHING

A Monthly Publication Relating to the Arts of Refining, Alloying, Casting, Rolling, Plating, Polishing and Finishing of the Non-Ferrous Metals and Their Alloys

ESTABLISHED 1905 NEW YORK, APRIL, 1929 VOL. 25. No. 4

Plating Research Meeting in Newark

A Report of the Joint Meeting of the Research Committee of the American Electroplaters' Society and the Newark Branch on Saturday, April 6, 1929

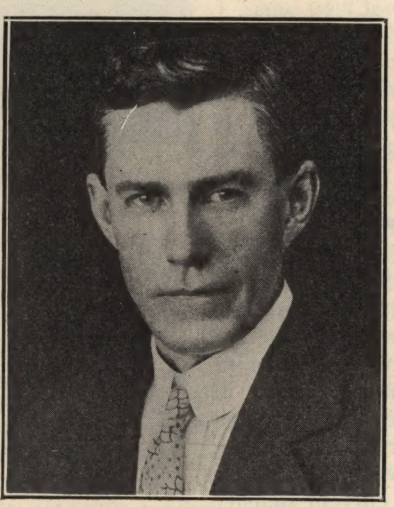
A MEETING was held in Newark, N. J., on April 6, 1929, of the Research Committee of the American Electroplaters' Society, at the Elks Club. This meeting was run in conjunction with the annual meeting of the Newark Branch. There were two educational sessions, one from 9 A. M. to 12 M., and the other from 2 to 5 P. M. The morning session was presided over by O. J. Sizelove, Associate Editor of THE METAL INDUSTRY, and the afternoon session by R. J. O'Connor, chairman of the Research Committee.

Spotting Out

The first paper read was a final report of the research on spotting out by W. P. Barrows, Research Associate of the A. E. S. at the Bureau of Standards. Mr. Barrows divided spots into two classes, crystal spots and stain spots. There is no cure-all for spotting out, but certain measures can be taken to cut down the percentage of spoiled work.

Mr. Barrows recommended the following methods of preventing crystal spots:

1. The use of lacquer film.
2. Wrapping the finished work in waxed paper.
3. A super-imposed oil film.



Oliver J. Sizelove,
Chairman of Morning Session

Stain spots are the kind that occur on castings which are porous. They can also occur on stampings if the rolled metal is imperfect, but such cases are much less frequent. High humidity will always bring out stain spots if the base metal is at all porous.

Methods of prevention of stain spotting were recommended as follows:

1. Avoid alkaline solutions, if possible, for cleaning and plating.
2. The base metal should be as non-porous as possible. This, in a great measure, is up to the foundry, but as good castings as possible should be obtained.
3. Remove or reduce the alkaline solution included in the pores. This is, of course, difficult to do, but considerable help can be obtained by allowing the specimens to lie for twenty-four hours after plating and before finishing. During this period they spot out. These spots can be removed by proper dips and the article then finished in standard fashion.
4. Prevent moisture from entering the pores, for example, by using a lacquer impervious to moisture. Some lacquers are beneficial in this way and retard spotting considerably, but it is important to get the right kind of lacquer for the work. Of twenty-four different lacquers tested in three groups, in the first group of nine lacquers, 5 to 25 per cent of the parts spotted out; in the second group of six lacquers, 25 to 50 per cent of the lacquers spotted out; in the third group of nine lacquers, 50 to 100 per cent of the parts spotted out.

A series of plant tests were run to check the laboratory results. Special lacquers were used for each type depending upon their specific requirements. These plant tests corroborated the laboratory tests. It is particularly noteworthy that the procedure of allowing the work to spot out before putting on the final finish, then dipping to remove the spots, finishing and lacquering, reduced the ultimate spotting out by over 66 per cent.

F. J. Hanlon, in the discussion, told of his experience with spotting out. He succeeded in eliminating it to a great extent by baking the parts before the final finishing, raising the temperature from 50 to 300 degrees F., for about one and a half hours. He allowed the parts to cool to room temperature in the oven; then

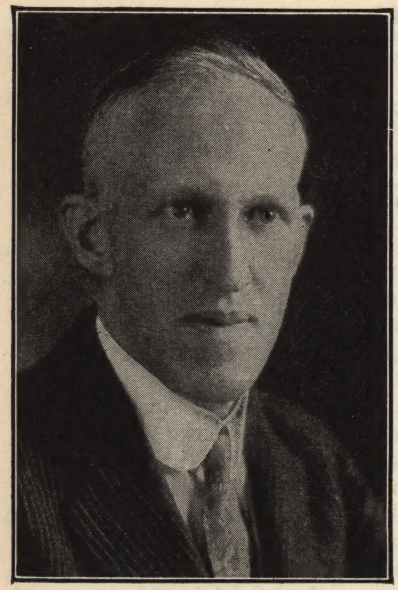
took out the pieces and finished them in the regular fashion. This method cut down the spotting to 12 per cent of its former incidence.

Dr. Graham warned platers against grinding down their casting too far in preparing for plating. All castings have blow holes or pits under the surface and the grinding simply works down into this space.

Chromium Plating

A report was given by Dr. Blum of the Bureau of Standards who outlined the researches in progress at that Bureau. Special problems were as follows:

1. Chromium plating methods.
2. Health measures in chromium plating. (For a report of this work done together with the U. S. Public Health Service, see THE METAL INDUSTRY for November, 1928, page 485 and THE BRASS WORLD for November, 1928, page 345.)
3. Mechanical applications of chromium plating.
4. Specifications for chromium plating. Some of these specifications are, for example, that deposits of chromium alone should have a thickness of .0002". If chromium is deposited on nickel, the nickel should be .0002" and the chromium .00002".



Dr. William Blum,
In Charge of Plating Research at Bureau of Standards, Who Presented an Outline of Work Done in Chromium at the Bureau's Laboratories in Washington.

Throwing Power in Chromium Plating

H. L. Farber, Research Associate of the American Electroplaters' Society at the Bureau of Standards, read a paper on Throwing Power in Chromium Solutions. He suggested having anodes shaped to the work so that the metal would have the same distance to travel to any point of the parts to be plated. He also pointed out that in irregularly shaped pieces certain points should be shielded to keep them from drawing more than their share of metal. Anodes should be far enough from the work to equalize the proportion, as far as possible, of the current density over all parts of the work. Proper racking is a most important factor.

Mr. Farber described the effects of the variations in composition of solution, temperature, current density, etc. The maximum throwing power was obtained at high temperatures and high current densities.

He recommended for the best working conditions, the following:

Chromic acid .... 33 ounces per gallon
Sulphuric acid ... 16/100 ounces per gallon

Eight volts; 280 amperes per square foot; 130 degrees F.

Under normal conditions, however it is rare that 8 volts can be obtained economically. Using 6 volts, he recommended the following:

Chromic acid .... 53 ounces per gallon
Sulphuric acid ... 27/100 ounces per gallon

Temperature 104 degrees F.; 56 amperes per square foot.

Mr. Farber pointed out that the materials worked with in this research were of the purest type and that his conclusions might be effected by impurities which occur in solutions by using materials of not so high a grade.

This paper was followed by a general discussion on chromium plating problems.

Analysis of Cyanide Plating Solutions

M. R. Thompson of the Bureau of Standards presented a progress report on this research. It seems that the "Leibig" titration with silver nitrate is reliable for silver solutions. It is planned to extend the work to copper, zinc, brass, cadmium and gold.

Measurement of pH of Nickel Solutions

The afternoon session began at 2 P. M., with R. J. O'Connor, chairman of the Research Committee, presiding. Dr. Blum read a report outlining investigation on the measurement of pH of nickel plating solutions. He traced the history and development of this method of analysis. There are three ways of measuring pH which differ slightly in their numerical results. It is still an open question as to which method should be accepted as standard by the plating industry and this was the topic for general discussion.

Addition Agents in Copper Electrotyping Solutions

R. O. Hull, Research Associate of the International Association of Electrotypers, read a comprehensive paper on his work on addition agents. He recommended a solution containing 33 oz. copper sulphate; 10 oz. sulphuric acid; 13/100 oz. carbolic acid, added as phenol-sulphuric acid; Temperature 104° F.; 280 Amps per sq. ft.; agitated solution.

Iron Deposition

C. T. Thomas of the Bureau of Engraving and Printing read a paper on the deposition of thick coatings of iron. He recommended the following solution:

Water .... 1 gallon
Ferrous chloride—$FeCl_2 \cdot 4H_2O$....53 ounces
Calcium chloride—$CaCl_2$ ....60 ounces

Free hydrochloric acid—small amount, say 0.01 to 0.02 normal; temperature 196 degrees F.; 65 amperes per square foot.

This solution deposits about .003" per hour. The anodes are hung in a diaphragm, for example, a porous alundum pot, to prevent sediment and impurities from going over. The deposit has a tensile strength of about 56,000 pounds per square inch and an elongation of 20 per cent.

Tanks should be carefully made. The danger to these tanks is the dropping of the heavy anodes which cut through the lining and allow the solution to corrode the tank and leak through. It is thought that a tank lined with acid-proof cement may prove the best.

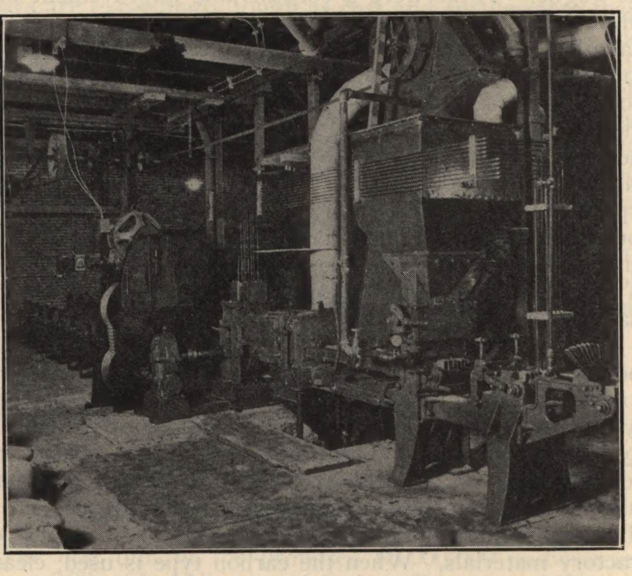
Entertainment

After the close of the afternoon session, the eleventh annual banquet of the Newark Branch was held. Tables were set for 550 guests. Souvenirs were presented to the ladies and men and dancing and entertainment followed the banqdet. The Amrad radio was drawn for and won by Mr. Kelshaw of the Matchless Metal Polish Company of Glen Ridge, N. J.

Process for Removing Metallic Scale

The Standard Equipment Company, Inc., New Haven, Conn., has placed on the market a new type of machinery which is used in a process for removing scale from non-ferrous metals, steel and iron. The process and the machinery was developed by C. A. Dreisbach and associates, who are identified with the Standard company. Mr. Dreisbach, who spent a number of years in research which led to the development of the equipment, invented the sand blast machine known as the New Haven Model "A" Barrel and Hose type, which is now manufactured by the Standard company and widely used in industry.

With regard to the new process, the Standard company states that Mr. Dreisbach has experimented for years with various kinds of abrasives for sand blasting and also with varying pressures, in an effort to develop a method of taking off scale, but that this work did not result in any thoroughly satisfactory process for finishing strip steel, wire, rod, etc., cold rolled. The impact which removed the scale usually was found to leave tiny pits in the metal, the size of the indentation varying with the angle of impact. He kept accurate records of all experiments and thus gathered up a wealth of invaluable data



Machinery for Removing Scale from Metals

on the subject. Finally, he designed and constructed an experimental machine which he used in further research, and this work resulted in a process for removing scale from steel and leaving a smooth finish with one pass, free from pits. The principles of the experimental machine were then incorporated into a standard design, equipped with chambers, nozzles, compressor, etc., all designed after careful study to get the finest possible combination of elements. Consideration was given at all times to durability, capacity for production, types of materials and also to replacement costs of parts. Then a machine was designed for removing scale and oxide from copper alloy rod. This type of machine performed the work at a rate of 50 to 70 feet per minute. Similar machine was adapted to cleaning steel golf club shafts at the rate of six per minute.

A complete equipment for scale removal from hot rolled strip steel has just been placed in operation at the Athenia-Clifton, N. J., plant of the Athenia Steel Company, 135 William Street, New York City, where it may be seen in operation, according to the makers. The Athenia Steel Company manufactures high grade high and low carbon cold rolled strip steel. To improve the product and cleaning conditions that company installed the first Model RS Standard Patent Automatic Scouring Machine, which is shown in the accompanying picture taken at their plant. The pulling roll with compressed air control and special type of eight reel winder are also a new design made by The Standard Equipment Company, Inc., for handling the one to eight strands of stock through the scouring machine.

This machine will take a continuous feed of one or more strips up to 7 in. wide and is cleaning two sides and edges of hot rolled high carbon steel at rate of 35 to 45 feet per minute and annealed and tempered stock at 40 to 60 feet per minute in one pass, the makers claim.

The control levers for operating the pulling roll is in easy reach of the stock supply man at front end of machine, the corresponding lever thrown down will grip and release pull on the respective strand holding it stationary for welding on a new strand or coil.

Each winding drum or reel is provided with a clutch foot lever control to stop for removing the finished coil and take up and wind new coil coming through.

The abrasive or sand in the scouring machine is used over and over, the dust is removed by exhaust system into a cloth screen dust arrester, so that the operators are not exposed to any dust conditions while operating. A machine is now being designed which will take one or more strands of stock up to 14 in. wide. Wider models are contemplated. The model RS and RT scouring machines will also handle wire and rod up to about ½ in. diameter in any number of strands equal to the width or capacity of the scouring chamber.

Aluminum Free of Oxides

A new and radical method of producing aluminum which is free of oxides and which displays remarkable physical properties has been developed and put into use by the National Bronze and Aluminum Foundry Company of Cleveland, Ohio, that company announces. It is stated that the process for producing this aluminum was completed about eighteen months ago and was patented. The metal was then offered to the public, the company producing castings of the metal, known as Tenual, with considerable success. This found favor in the trade and the demand for it grew to such an extent that the company, despite its very large productive capacity, built up during twenty-one years of activity in the foundry business, was pressed beyond its capacity, necessitating large plant facilities. For this reason the company has recently broken ground for a large plant addition.

The new addition will expand the National company's capacity for production about fifty per cent. J. H. Shafner, president of the company, states that a good deal of the new equipment needed for the added capacity has been purchased but that more will undoubtedly be required before the addition is entirely put into operation.

Plating Nickel on Aluminum

Q.—We would greatly appreciate receiving your formula for the nickel solution for plating aluminum only.

A.—Plating of nickel on aluminum is not as much a matter of a formula for a nickel solution as it is the method of preparing the surface of the aluminum to receive the deposit. Any nickel solution that deposits satisfactorily on zinc or die castings can be used to plate on aluminum. For details of the method, we would refer you to the BRASS WORLD for May, 1928, pages 153-154, "Deposition of Nickel on Aluminum."—JOSEPH HAAS.

Refractories for the Brass Foundry

Recent years have seen many important developments in refractory materials for use in non-ferrous metal melting furnaces, says Furman South, Jr., president of the Lava Crucible Company, Pittsburgh, Pa., in an article entitled "Super-Refractories—A Boon to the Brass Foundry." Both the materials and shapes have been improved and brought to a high state of efficiency, study having been devoted to practically all angles of the problem of attaining refractories as nearly perfect as possible. The outstanding achievements, he says, have been in refractories for the crucible furnace, in regard to which he writes as follows:

Prior to the advent of gas and oil crucible furnaces, melting was done in coal or coke fired pit furnaces. The refractory problem was not serious, because the only refractory needed was for the cylindrical lining wall. With natural draft there was no terrific cutting action, and the ordinary fire brick refractory, made in the form of circle brick, served admirably. The introduction of the gas and oil furnaces, stationary and tilting type, brought new problems which have increased steadily with the demand for faster melting and the higher temperatures required by a multitude of new metal mixtures that have been developed.

At the beginning, the ordinary fire brick refractories were the only ones available for these furnaces. But these have failed to keep up with the demands put upon them. There are three separate refractory problems, exclusive of the crucible, in a crucible furnace: (1) the furnace cover; (2) base block; and (3) lining. Two of these are peculiar to the gas and oil furnace, namely the furnace cover and the base or rest block.

The furnace cover offers a number of problems. It must be made, preferably in a single piece, to diameters up to 38 inches, and weights exceeding 300 pounds to the piece. It is subjected to repeated heating and cooling, with the resultant expansion and contraction. It is seldom rigidly supported by its metal band, and is subject to torsional strains which tend, through twisting action, to crack it. It must resist the highest temperatures existing in the furnace, and through its exhaust hole must withstand the action of high temperature gases at high velocity, which have a terrific fusing and erosive action.

The ordinary fire brick cover fails to meet these demands. It is not strong physically and will crack through torsional action of the band. It will spall under repeated heating and cooling. And its center hole will be eroded rapidly, increasing the size of the exhaust hole from which the waste gases escape, with resultant increase in fuel consumption and slowing up of melting time, with its direct effect on the production of the furnace. Its life is only a matter of a few weeks, and during a large part of this time it is performing inefficiently.

The development of the super-refractory cover has eliminated this undesirable and costly condition. The silicon-carbide type has been the most serviceable one yet developed. It has great physical strength and when supported properly will not crack at all. It does not spall or sand away. It has extremely high temperature resistance which is particularly effective at the exhaust hole. It is made either in a single piece, or with replaceable center inserts, which guarantee the exact maintenance of the exhaust hole throughout its life. It gives months of service and in many instances, service of more than a year is reported.

The base or rest block is of more importance than the average foundryman credits it with. A crucible should be exactly centered in the furnace. Otherwise combustion efficiency is impaired, and the life of the crucible is reduced by the effect of different temperature on opposite sides of the crucible. The crucible should also be maintained at a given position in the furnace as regards burner position and clearance under the cover, for proper performance. A block that will not soften and squat is necessary for this. The base block should be a conductor of heat to insure using all of the surfaces of the crucible for heat transfer, resulting in greater combustion efficiency and increased crucible life. These requirements are met by the super-refractory base block of the carbon type. It has the physical strength to carry the weight of the crucible with its charge of metal, the temperature resistance to prevent softening, and being of the carbon type, is a high conductor of heat.

The furnace lining itself is the most important of the three items. As mentioned above, the original developments were with the fire brick refractory in the form of circle brick. These have always been a source of frequent renewal, laborious repair, inefficient operation and high maintenance cost to the foundryman. Later the use of plastics for rammed-in monolithic linings was the vogue. These were a considerable improvement but offered the great disadvantage of laboriousness of installation, and length of time necessary for relining. And unless properly installed, gave less than normal life. Both of the above types require constant maintenance and the expense incidental thereto. A recent development has eliminated the problems and expense that have had to be contended with. This development is the ring type of crucible furnace lining. The lining is made up of four or five annular rings. The burner and slag holes, and any any other openings required, are built into the lining in exact position and of proper size and contour, by the manufacturer.

To install the lining it is only necessary to drop the individual rings, which are easy to handle, into their position in the furnace, in the order laid out and marked by the manufacturer. A thin layer of joint cement is spread on each ring. The lining can be put into operation immediately, and the average time for the complete installation, from the start, until the heat is turned on, is about **one hour.** The linings are made of super-refractory materials. When the carbon type is used, clearance is allowed between the lining and the furnace shell for filling with insulating material in powdered form. This clearance is made possible by the fact that the wall thickness of these super-refractory rings can be reduced. This type of lining serves for months before maintenance is necessary. The rate of erosion or burning out is very slow, and the proper combustion areas of the furnace are maintained for the maximum length of time.

When a furnace is newly equipped with refractories, it is ready to operate at its greatest efficiency. The diameter and walls of the lining are correct. The exhaust hole in the cover is exact to design and the crucible is properly positioned and supported by the base block.

With wear, the combustion areas of a lining are enlarged, increasing the amount of fuel necessary to maintain a given temperature. With wear, the exhaust hole in a cover is enlarged, allowing more rapid escape of the exhaust gases, and tending to lower the temperature of the furnace. The burning of bellies in the lining throws the combustion out of balance and creates zones of varying temperatures around the furnace, shortening the life of the crucible. For it is a proven fact that crucibles give better service in well conditioned linings than in worn ones.

In short, worn linings increase fuel consumption, de-

crease crucible life, and decrease the melting rate of the furnace, which means less production and at greater cost.

Let us assume that one type of lining costs twice as much as another and gives twice the service of the other. It could readily be thought that there would be nothing to choose between the two, outside of the first type having the advantage of a labor saving in its one installation. But it may be overlooked that the first type, because of its ability to give long service, will maintain its efficient areas for a greater length of time than the total of the other two, with a longer period of efficient fuel consumption, efficient production rate, and high crucible life.

Such savings do not reflect themselves in cost records to the direct credit of the item responsible for them. But they are there, in the final cost, having their effect on the profit margin.

White Alloy for Hardware

To the Editor of the BRASS WORLD:

I have noted in the November issue of BRASS WORLD, on page 336, a question concerning White Alloy for Hardware. The answer given by Mr. Reardon does not show a knowledge of recent developments in zinc base alloys.

Zinc base alloys for die castings have been recently developed which show a tensile strength of from 40,000 to 50,000 pounds per square inch with an elongation of from 3 to 5 per cent and a Charpy impact value of 5 to 10 foot pounds on a quarter inch square test piece. These alloys are exceedingly tough as cast and furthermore they do not become appreciably less tough upon aging as the old fashioned zinc base alloys did. As a matter of fact, these alloys would be very desirable for hardware such as pulls, entrance handles, door knockers, etc., about which the question was written. Such alloys have been used for such parts with entire satisfaction for years and their strength is greatly in excess of that of certain grades of yellow brass which are often used for this purpose.

We trust that you will take steps to correct the misinformation given in this answer, because proponents of zinc base alloys are having difficulty in overcoming the prejudices of certain metallurgists concerning them.

The Stewart Die Casting Corporation,
D. L. COLWELL, Metallurgist
Chicago, Ill., March 15, 1929.

To the Editor of the BRASS WORLD:

I have the letter of D. L. Colwell, metallurgist of the Stewart Die Casting Corporation, Chicago.

In answer, would say I am fully aware of the quality of zinc alloys for die casting. I do not agree, however, that zinc base alloys are suitable for hardware such as required by the manufacturer referred to in this question. When cast in sand, zinc alloy will not compare with die castings, and under no condition compares with the alloy given, which is German silver and has a tensile strength of 60,000 lbs. per square inch, 30,000 yield and 40 per cent elongation. It will not pit like zinc alloy when exposed to the weather and will not turn black.

Most of this Spanish style is hammered and zinc alloy will not stand hammering. At the best has not over 4 per cent elongation, which I assume even Mr. Colwell will agree is not very substantial for hardware such as referred to (large hinges, etc., Spanish hardware).

I have never known of any manufacturer of hardware using zinc base metal. I do not believe you could get any reliable architect even to agree to using zinc base metal for hardware, and the only use I can see for zinc base sand cast hardware would be 5 and 10-cent store hardware, for which cast iron nickel-plated is preferable.

I would not recommend zinc base metal, either die cast or sand cast, for Spanish hardware.

Detroit, Mich., April 8, 1929. —W. J. REARDON.

Chase Brass Midwest Mill Begun

The first unit of the proposed $6,000,000 midwestern plant of The Chase Brass and Copper Company of Waterbury, Conn., is now under construction at Euclid, Ohio, near Cleveland, and completion of the unit is expected by midsummer, according to The Austin Company, designers and builders of the plant. The new structure will be the rod and sheet mill and will stand on a portion of the 60 acres acquired by the brass company and bounded on two sides by the Nickel Plate and the New York Central rail lines. Incidentally, the company has under option 40 additional acres. The main building of the unit under construction will be 225 by 1,000 feet in area and so designed that it will be capable of expansion in three different directions. Running longitudinally through this building will be three aisles each about 75 feet wide, with a 10-ton traveling crane over each and a 70 foot clear span for each crane. Brick and steel sash construction is specified, with roofing of cement tile slabs and steel columns supporting the roof at intervals of 75 feet transversely and 40 feet longitudinally. The building will be one story high, with a basement under the part to be used for casting. A tunnel under the entire length of the building contains all service pipe lines. The roof construction is of sawtooth design, each tooth being a 40-foot span.

Three thousand tons of structural steel will be used; 100,000 square feet of sash and glass; two miles of sash operators; 2,500 squares of roofng and 10,000 yards of concrete.

A complete power plant will be located in a separate building. Because of the large quantities of water required in production, the company will run its own water line from Lake Erie, two miles distant. Plumbing, heat-line from Lake Erie, two miles distant.

Magnesium Alloy Castings

A lecture given December 13, 1928, before the Birmingham, England, Metallurgical Society, by E. Player, has just been published under the title of "The Production and Properties of Magnesium Alloy Castings." The paper is a complete summary of the present situation in magnesium alloy castings, with special reference to the type of alloy known as Elektron. The subject is dealt with comprehensively, the author covering the various aspects such as the history of the element and its chemical properties, the composition of Elektron alloys, physical properties of castings of Elektron, the foundry practice required, its protection against corrosion, the production of die castings of Elektron, applications of such castings, sheet metal, etc. The final perfection of these alloys, the author states in conclusion, has not yet been reached. However, there has been established a strong foundation of technical data upon which further research and development can safely proceed.

New Facts on Cadmium Plating for Rust Prevention

S. Wernick, Who Has Specialized in Electrodeposition for the Prevention of Corrosion, Presents Paper on Cadmium Plating Before British Society

By OUR LONDON CORRESPONDENT

WRITTEN ESPECIALLY FOR BRASS WORLD

A VERY instructive paper on the important subject of Cadmium Plating was read before the Electroplaters' and Depositors' Technical Society by S. Wernick, Hon. Secretary of the Society, at the February Meeting. The particular aspect of cadmium plating dealt with was that given by the title of the paper, "The Electrodeposition of Cadmium for Rust Prevention." The paper was well illustrated by numerous charts, lantern slides, and specimens of cadmium and cadmium-nickel platings after subjection to corrosion and mechanical tests. Dr. G. D. Bengough occupied the Chair.

The Paper

In his introductory remarks, Mr. Wernick said that one of the most important of the recent developments in the plating industry was the advent of cadmium plating for use primarily as a rust preventive of ferrous material. Its increasing application indicates that the deposit is generally considered to fulfil this function satisfactorily. The literature, however, shows that there has been marked divergence of opinion as to the efficiency of cadmium as a rust preventive, particularly as compared with zinc. Cadmium deposits may, however, differ widely in their physical properties, which largely affect their protective capacity, and it is probable that statements which are apparently contradictory might often have been rendered compatible were such details of the platings as the composition of the solution used, conditions of deposition, and thickness of the deposit indicated in each case. Assuming that such conditions as the use of reasonably homogeneous, non-porous base metal, effective preparation of the material before plating, etc., are postulated, then the protective capacity of the resultant plating will depend largely upon the fineness of the deposit (which is intimately bound up with the composition of the solution, and the electrical, mechanical and thermal conditions employed in plating), the amount of cadmium deposited per unit area (i.e., the thickness of the deposit), and the distribution of the deposit over the cathode area (which depends largely on the throwing power of the solution).

Composition of Solutions

A very wide divergence exists in the composition of cadmium plating solutions recommended by different authorities, and there can be little doubt that these must be productive of deposits possessing fundamentally different characteristics. Each ingredient in the plating solution (as will be shown) has a greater or less effect both on the type of deposit produced and the ultimate composition of the bath. In regard to the latter, most cadmium solutions have an inherent tendency to alter in composition tending with few exceptions to "build up" in metal content and reduce in free cyanide concentration, so that there is, in addition, a progressive variation in the characteristics of the deposit as the solution ages. Apart from this, the inconvenience and cost of managing such a solution is an important item to the plater.

Consequently, one of the most desirable features in cadmium plating is the development of a solution, the tendency of which to vary in composition is at a minimum. Such a solution will be most amenable to control, and will be most likely to produce a standard and efficient type of deposit.

Electrode Efficiency Ratio

The ideal stabilized cadmium plating solution is one in which the anode and cathode current efficiencies are each 100 per cent. In such a solution, the ratio of anode to cathode efficiency, or the Electrode Efficiency Ratio, is unity. Like the majority of cyanide solutions, the anode efficiency of the average cadmium solution exceeds the cathode efficiency to a very appreciable extent. This excess may be as high as 25 per cent., i.e., the electrode efficiency ratio may reach 1.25. This ratio may be decreased by using insoluble anodes, as well as cadmium anodes, in the same solution. The effect of decreasing the effective cadmium area upon the electrode efficiency ratio is shown below in the case of one solution, the area of anode and cathode being identical:

Per cent insoluble anode area	Electrode efficiency ratio
0	1.21
50	1.07
75	1.04

The effect is due to a reduction in the overall anode C.D., although this reduction is by no means in proportion to the ratio of soluble anode area. This method of stabilizing the cadmium solution is widely used; it appears to be fairly effective, though it is not ideal. In practice, there is a progressive change in the ratio soluble/insoluble anode area due to the gradual solution of the cadmium. The material usually used as the "insoluble" anode is steel, but to a small extent it is soluble and introduces an undesirable ingredient into the solution. It has also been stated that it caused the decomposition of the ingredients in the solution, although others attribute a beneficial effect, suggesting that the tendency to build up carbonate in solution is lessened.

Effects of Variations in the Composition of the Solution

It may be anticipated from theory that the rate of solution and deposition of cadmium metal is likely to be affected by the concentration of the metal, the free cyanide and the caustic alkali present, and a study of the effect of the concentration of the principal constituents in the solution upon the electrode efficiency ratio undertaken by the author yielded the results outlined below. An important property of the solution which affects the economy of the cadmium plating process is its conductance and measurements of the latter were made concurrently so that the effect of an increasing concentration of the essential ingredients upon the conductance of the solution was obtained at the same time. Finally, the effect upon the appearance and fineness (grain size) of the deposit was also noted.

1. Effect of Increasing Cadmium Content.

The cadmium content favored by different writers

varies from about 5 grams to over 30 grams per litre. Satisfactory deposits are obtainable at the lower concentrations, and, no doubt, considerations of economy in the case of such an expensive metal as cadmium have often led to their adoption in preference to solutions of higher cadmium content. As expected, however, it was found that progressive decrease in the electrode efficiency ratio occurred with increase in cadmium content, this being appreciable, even by doubling the lower limit quoted above, i.e., when equal to 16 grams, and approaching unity at about 30 grams cadmium per litre. At the same time, there is a marked rise in the conductivity of the solution, amounting to almost twice its original value at this figure. Deposits having a very fine crystal structure—"structureless" to the naked eye—are obtainable with a cadmium content in excess of 30 gm./1. Due to deficiency in free cyanide, "fouling" of the anode occurred with solutions of low cadmium concentration, but this occurred to a decreasing extent with increase in the cadmium content, the anode remaining clean (except for a natural darkening) when the cadmium content reached 25 gm./.1. and over.

2. Effect of Increasing Free Cyanide.

Free cyanide is another constituent which varies widely in concentration in different formulæ for cadmium plating solutions. From 6 to 60 grams per litre has been recommended. This constituent is stated to have a very pronounced effect on the solution of the anode, but, using a solution having a cadmium content of approximately 30 gm./1, upon which figure the free cyanide is calculated as percentage (not as per cent present in solution), increasing free cyanide content was found to increase only very slightly the electrode efficiency ratio, even when the concentration of free cyanide reached 125 per cent. At higher concentrations, however, there is a marked increase in the electrode efficiency ratio. Free cyanide may, therefore, vary within fairly wide limits at comparatively low concentrations, but for stability of the solution must be rigorously controlled at higher concentrations, excess beyond a given limit resulting in rapid building up in metal content. At the lower concentrations, there does not appear to be a progressive increase in the electrode efficiency ratio, but actual slight decreases were noted. It is possible that, at certain concentrations of cyanide polarization of the anode may occur.

In regard to the conductivity of the solution, there is a very pronounced increase in this electrical property of the solution, with progressive increase in free cyanide. Quite a substantial increase is, however, attained with a free cyanide content of about 100 per cent, and, although better conductivity is obtainable with more cyanide, this is a safe figure to maintain. The effect of increasing free cyanide content upon the deposit is distinctly noticeable, there being a marked reduction in the grain size, the deposit also becoming white in color.

A further drawback of the higher free cyanide content is the increase in gassing which results, particularly in the early stages of deposition. It is possible that this is due to the higher hydrogen over-voltage on cadmium as compared with iron, causing the gas evolution to slacken, and eventually cease almost entirely when the cathode is well covered with cadmium.

The anode corrosion obtainable with resultant cleanliness of anode surface is quite efficient in solutions of comparatively lower free cyanide content.

3. Effect of Increasing Alkali Content.

This constituent is usually added as a means of increasing the conductivity of the solution. It is not an essential constituent, being completely omitted from some formulæ. Experiment has, however, indicated that the presence of a caustic alkali in the solution is of definite value, having a marked tendency to bring the electrode efficiency ratio nearer to unity. It is possible, too, by its use, to standardize the alkalinity of the solution. The ratio was found to decrease progressively as the alkali content (caustic soda was employed) was increased from 1.5 to 30 gm./1. On the other hand, contrary to expectation, the conductivity was not appreciably affected. The free cyanide content of the solution used was 56 per cent, calculated on the combined cyanide present. The addition of the caustic soda was also found to have a markedly beneficial effect on the deposit, the grain size of which was progressively reduced, becoming structureless at the upper limit, and the color decidedly whiter. Tendency to streaking and patchiness at the cathode, occurring occasionally in absence of caustic soda, were also found to cease when caustic was present. There is little gassing at the anode, which is rendered a dark-grey color, remaining unfouled, and showing uniform corrosion. Slight gassing occurred at the cathode only at the highest caustic concentration.

Physical Conditions

After examining the effect of temperature of the solution and current density, the author said that to summarize, the conditions best suited to the attainment of (a) a deposit of small grain size, (b) a solution of optimum conductivity, (c) a solution of maximum stability, i.e., having electrode efficiency ratio as near as possible to unity, appear to be as follows:

Metal Content—Relatively high concentrations are best; 30 gms./1. cadmium content gives good results.

Free Cyanide—May vary within fairly wide limits, about 100 per cent, (over the combined cyanide content) giving most favorable results. Appreciable excess beyond this figure markedly affects stability of solution.

Caustic Alkali—A desirable constituent, 15 to 30 gms./1. is a useful range, the upper limit giving superior results.

Temperature—High temperatures of the solution are best avoided.

C.D.—10-15 amps./ft.^{2} gives best results.

A solution made up on these lines yielded an electrode efficiency ratio slightly in excess of unity, a high conductivity, the deposit being "structureless" and the condition of the anode satisfactory.

After dealing with the use of addition agents and the throwing power of the solution, the author referring to the properties of the deposit, said the superior corrosion resistance of cadmium deposits as compared with zinc is undoubtedly largely due to its lesser chemical reactivity. It is the ideal protective for ferrous material insofar as it is nearest to it in the anodic side of the Electrochemical Series, whereas the p.d. between zinc and iron is quite appreciable. While, therefore, the intrinsic protection afforded by zinc is higher than that which cadmium can give due to its greater solution pressure, its rate of preferential or sacrificial corrosion is for the same reason also higher. For this reason, a smaller amount of cadmium or a thinner deposit provides the protection afforded by a comparatively thick zinc deposit. This was fully borne out in the case of a number of specimens of zinc and cadmium plating submitted to a number of different corrosion tests.

Reaction to Chemicals

In regard to the reactivity of zinc as compared with cadmium deposits, tests were carried out in which platings were placed in contact with a number of representative chemicals, the most interesting results being briefly as follows:

In the case of the strong acids, zinc plate was more rapidly attacked, while after the coating had been dis-

solved, corrosion of the underlying ferrous metal was slower in the case of the cadmium-coated test-piece than that which had been zinc plated. Possibly, this is due to an alloy formation at the cadmium-base metal juncture. Weak acids strip cadmium plating very slowly, as compared with zinc plating, and the corrosion of the base metal is delayed in proportion.

Alkalies, though more ready in their attack upon zinc plating, cause a considerable darkening and eventful blackening of the cadmium surface, this being more marked with strong than with weak alkalies. Little stripping of the cadmium, however, occurs, while zinc is comparatively rapidly stripped in strongly alkaline solutions and to a considerable extent in mild alkalies.

Ammonia solution discolors cadmium, which gradually dissolves, this occurring much earlier with zinc plating. Corrosion of the base metal is more rapid in the latter case. Ammonia fumes are markedly corrosive on zinc plating, cadmium plating being practically unaffected by these fumes over extended periods.

Ammonium chloride and sodium citrate, examples of salts which readily dissociate in solution with formation of corrosive ions, are more rapid in their action upon zinc plating, there being a marked difference in the extent of the corrosion produced, cadmium plating being easily superior.

Benzol and probably most neutral organic liquids are without apparent effect over extended periods on either plating.

After giving the result of some corrosion tests on cadmium and zinc plating, Mr. Wernick said that thicker cadmium deposits give appreciably better protection. A deposit 0.4 mil. thick, for example, as compared with one 0.3 mil. thick, provides protection considerably in excess of the ratio of these thicknesses. For efficient protection, this thickness—0.4 mil.—is a desirable standard to adopt in commercial work, and it is suggested that the more generally advocted 0.2 mil. deposit be reserved for precision work, etc., where the thicker deposit cannot be entertained.

Composite Deposits

The use of cadmium plating as an undercoating to more pleasing finishes of less protective capacity has been suggested and is actually in use as a standard commercial finish in some plants. Corrosion tests were carried out in particular upon cadmium-plated ferrous material to which both metallic and non-metallic finishes were subsequently applied. Nickel, as expected from theoretical considerations, is far more readily deposited upon a cadmium surface than upon zinc, but the composite deposit was found to be quite inferior to cadmium alone as a corrosion preventive.

A little reflection will indicate the cause. On exposure of the composite cadmium-nickel finish, the cadmium continues to function as a protective by virtue of its own sacrificial corrosion. If it did not, the very purpose for which it was applied would be defeated. At pores in the nickel or other superposed finish, the cadmium accordingly reacts with the corrosive elements to form a cadmium corrosion product. The first stage in the corrosion of the composite plating is the appearance of a white salt at the weakest points in the nickel surface, at the center of which after the cadmium is totally "sacrificed," rusting of the underlying ferrous metal invariably occurs. Before rusting, the material presents a decidedly unsightly appearance. In the case of a superposed enamel finish, the same white corrosion product appears, causing the enamel to flake away probably because of the increased volume occupied by the cadmium salt.

The thickness of the superposed nickel plating is an important factor prolonging the time before corrosion occurs, the effect no doubt being due to a reduction in porosity, but since this remedy rests upon the efficiency with which the exposure of the cadmium to the atmosphere is prevented, it is obviously of negative value. Underlaying nickel with copper showed little or no improvement while heat treatment of the cadmium after deposition was similarly ineffective. To sum up, while the composite cadmium-nickel deposit is superior in its protective capacity to nickel alone, this protection is considerably less than that of the cadmium deposit alone.

Mechanical Properities

It is well known that mechanical defects in the deposit have a marked effect upon its protective capacity. One of the defects to which cadmium deposits are particularly prone is blistering. To avoid this, it is important to ensure that the work has a chemically clean surface, and also that cathodic gassing is at a minimum.

Relatively high C.D.'s and elimination of preliminary "flashing" favor the ultimate development of blistering. In the case of the composite cadmium-nickel deposit, G. B. Hogaboom suggests blistering may be due to the oxidation of the underlying cadmium.

The adhesion of a good cadmium deposit is of a high order, no separation of the deposit from the base metal occurring in fracturing in a cupping test or when the plating is bent double. Comparatively thick cadmium deposits show considerable flexibility and perfect adhesion in twisting, bending and coiling tests, when applied to wire as thin as 0.05 inch in diameter. Although cadmium ordinarily becomes embrittled at 100° C., nevertheless the deposited cadmium does not appear to be greatly affected when subjected to subsequent heat-treatment at this temperature—at least insofar as its flexibility is concerned. Bend tests indicate that there is some tendency to brittleness, but this is not marked.

The composite cadmium-nickel deposit subjected to these tests showed a marked decrease in flexibility, as well as an increase in brittleness, although it is probable that this depends, to a great extent, on the hardness of the deposited nickel. Although no signs of parting of the composite plating occurred in the case of plated sheets under a cupping test, flaking readily occurred when the cadmium-nickel was applied to wires, both in twisting and coiling tests, although it showed up well in the bending test. The quality of the nickel deposit is largely the determining factor here, since the cadmium undercoat appears to remain little affected.

Discussion

Opening the discussion, the Chairman, **Dr. G. D. Bengough,** congratulated the author and said this paper alone was worth about 5 years' subscription to the Society. He asked if there was any evidence of alloy formation at the junction of cadmium with the base metal. There was a great field for cadmium plating in resisting alkalies, and also ammonium chloride which presented big problems in industry. Mr. Wernick's defense of the salt spray test for testing metal coatings was reasonable; it has its practical uses but must not be used too widely, and only for comparative purposes.

E. A. Ollard said the author had shown that cadmium could be definitely superior to zinc if care was taken in its deposition. Often a finer deposit was obtained in a barrel vat than in a still vat; addition agents were necessary in the latter. Yellow dextrin gave good results. With regard to high anode solubility, could not this be overcome by reducing the anode area? Was the effect of carbonate in a cadmium solution as detrimental as in silver

solution? In the corrosion of cadmium, it is found to break down suddenly and the salt spray test is not representative of outdoor exposure.

S. E. Weill said that cadmium was really more plentiful than was thought, but prices were kept up. Cadmium was a fairly simply metal to deposit, though of course the quality was important. Although cadmium was as good if not better than zinc as a rustproofing material, it was no good at all as an undercoat. Nickel or enamel above cadmium had been found to give way in 6 months.

G. E. Gardam said that the ferroxyl test showed no reaction with iron when in contact with cadmium, even when large areas were exposed. Owing to the high atomic weight of cadmium, it was deposited much more rapidly than zinc. It was however soft.

A. E. Boulter said sometimes the cadmium deposit was patchy, showing shades of white and yellow. Was there any difficulty in superposing nickel as on zinc? What available supplies of cadmium were there?

L. Goring said with regard to the composite coat he had found it advantageous to put nickel under cadmium and then overlay it with nickel again. It was very important to wash thoroughly owing to a tendency to spotting out; dilute weak acids are useful. The character of the deposit often varies with the addition agent used, there being different degrees of whiteness. If caustic soda were used in the solution, it was best to use the solution cold.

The Author then replied to the discussion, and on the motion of the Chairman, seconded by Mr. Ollard, was accorded a very hearty vote of thanks.

Removal of Acid Fumes from Pickling Rooms

In our March issue on page 54, we published an article on the Removal of Acid Fumes from Pickling Rooms, by Dr. James Silberstein. Inadvertently, the two illustrations mentioned in that article were omitted.

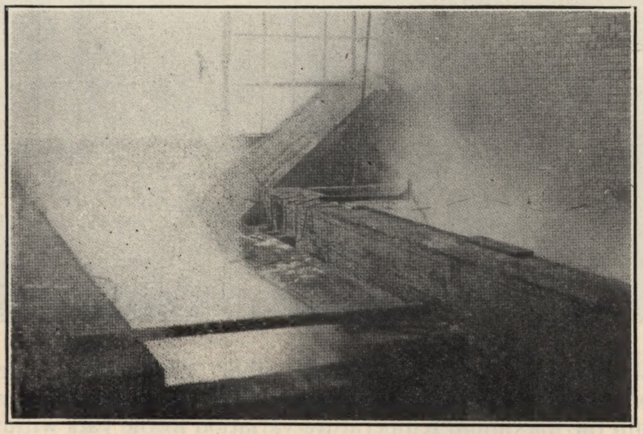


Fig. 1—Pickling Tanks with Exhaust Fans Not in Operation

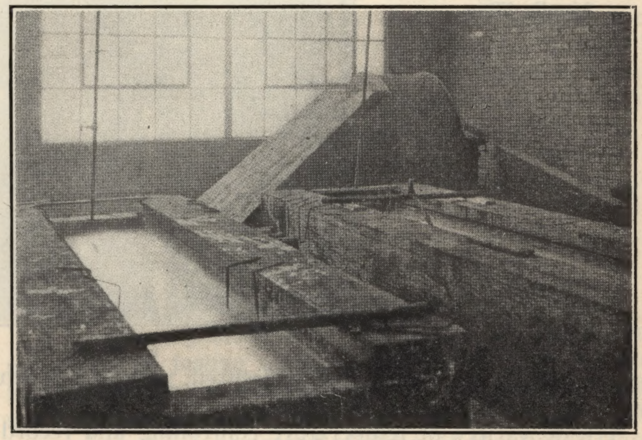


Fig. 2—The Same Tanks with Exhaust Fans Operating

These two illustrations are shown below. Figure 1 shows the vapors rising from the pickling tanks when the exhaust fan is not in operation. Figure 2 has a view of the same tanks when the fan is in operation. The fumes are drawn off to the side, directly from the surface of the tanks, through long narrow openings to ducts leading to the fan which discharges the fumes to a stack. There are no overhead exhaust systems; consequently no fumes can get near the operator even when he is bending over the tank.

Data on Nickel Plating

Q.—I would like to know if a non-electric copper dip would be all right for plating small articles previous to electroplating with nickel. If so, what formula would you suggest for preparing such a dip. If such a dip will not be satisfactory, please give me a formula for preparing a solution of 2 to 10 gallons for experimental copper plating on iron and steel.

Please state if it is necessary to put a deposit of copper on brass, copper and nickel articles before the articles are nickel plated. I am a beginner in the field and am seeking information to work on.

A.—While the copper coating that you could obtain on iron and steel articles by using a copper sulphate dip would be useful for some kinds of work, it would be entirely unsuitable as a preliminary coating to nickel plating because peeling would invariably result. We would advise you to make a 10 gallon solution of copper cyanide of the following composition:

Copper cyanide	4 ounces
Sodium cyanide	4 ounces
Sodium carbonate	2 ounces
Water	1 gallon

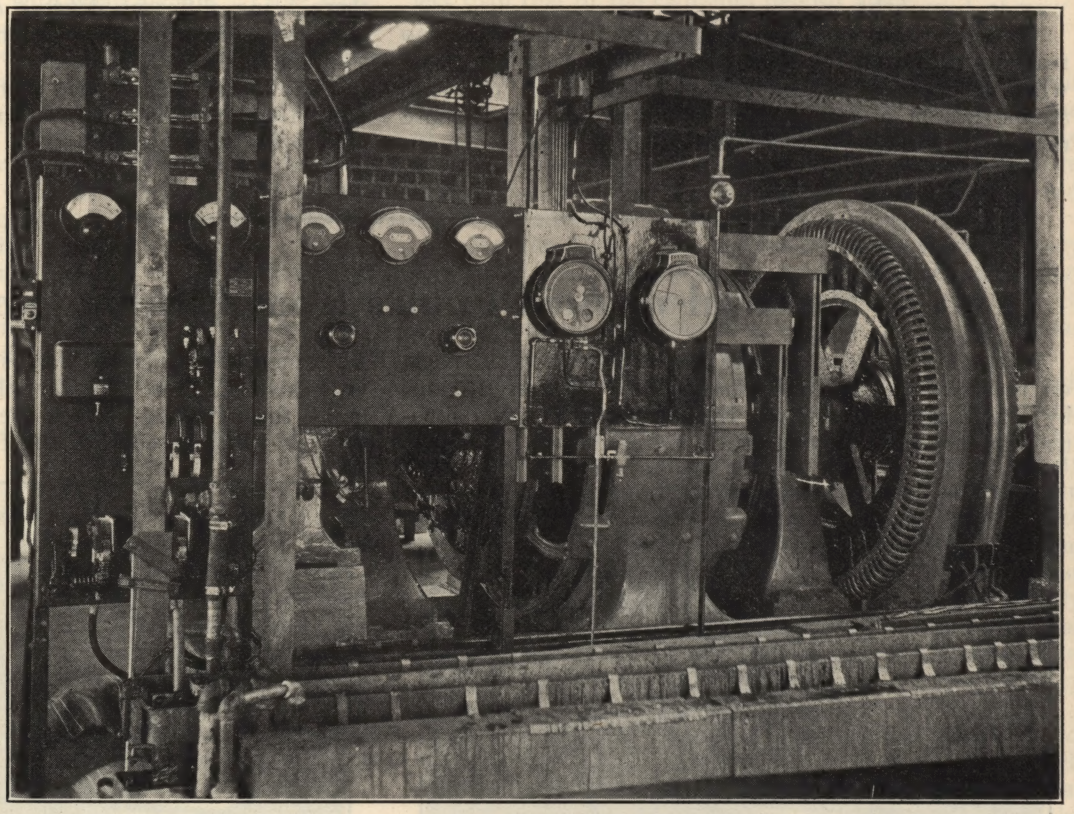
Plate with 2 to 2½ volts of current. Though it is not necessary, and under some circumstances advisable not to copper plate steel before nickel plating, we would advise you to do so because of your inexperience in electroplating.

—Joseph Haas.

Control Instruments for Chromium Baths

Perfection in chromium plating depends to a great extent upon the accuracy with which solutions and other involved operations are controlled. Temperature and current density are considered by authorities on chromium deposition to be two of the most important factors in the successful operation of a chromium bath. For this reason, there has been developed a great deal of apparatus by means of which accuracy can be assured, with consequent high quality chromium deposition.

A wide variety of temperature controlling and recording instruments has been developed and placed on the market by the C. J. Tagliabue Manufacturing Company, 18 to 88 Thirty-third Street, Brooklyn, New York. The company states that its apparatus has been installed in some of the largest and most successful chromium plating plants in the country. There are steam-operated and also air-operated types of controlling instruments. These are used to regulate the temperature of tanks that are heated by steam coils, cooled by water coils or which are equipped with coils which can either heat or cool a tank as desired. Recorder-controller systems are also available. The accompanying illustration shows what is known as the TAG single system duplex temperature controlled, air operated, and the TAG recording thermometer, as installed in one of the most prominent chromium plating plants in the middle west, a plant which produces chromium plated sheets for fabrication and other chromium plated products. These control instruments are adjusted to maintain the maximum temperature variation in the vats within one-half a degree.



A Complete Single System Duplex Temperature Controller, Air-Operated, as Used in One of the Leading Chromium Plants in the Middle West

Listed among the products of the Tagliabue company are the following instruments: automatic steam-operated temperature controllers, single system, direct connected; duplex type controllers of the same kind; diaphragm-motor valves; air-operated automatic single system temperature controllers; duplex controllers of the same kind; single system automatic temperature recorder-controllers; various types of indicating and recording thermometers.

Specifications for Roofing Sheets

Specifications for use in the purchase of Terne sheets or plates, commonly known as roofing sheets or roofing tin, are being promulgated by the Federal Specifications Board, Washington, D. C. A pamphlet just issued by and obtainable from the above named Board at the United States Bureau of Standards in Washington gives the specifications proposed on such sheets and plates and also on long Terne sheets, commonly known as long Ternes. The Board desires the comments of all who are interested in the specification of such sheets and plates, and suggestions will be considered carefully if received by the Board up to May 24, 1929.

Information on Finishes

Q.—I would like to know where I can get books or articles on burnishing and cleaning cast iron articles.

A.—First we would advise you to consult the indexes of the past issues of THE METAL INDUSTRY and BRASS WORLD for the names of articles you are interested in. Much practical information can be obtained from them.

In addition, look over the advertising pages in these journals. There you will find the most prominent companies in the fields in which you are interested. They usually can supply some literature which, together with articles in the two journals mentioned constitute the best sources of information. —JOSEPH HAAS.

Chromium Plating Fundamentals

A Discussion of Chromium Plating in All Its Aspects, Theoretical and Practical—Part 9*

By P. E. EDELMAN
Electrical Engineer

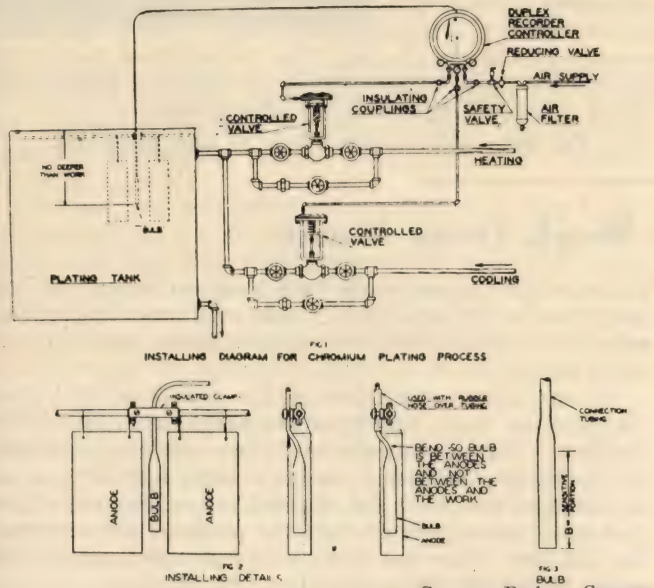
WRITTEN ESPECIALLY FOR BRASS WORLD

Regulation of Bath

THE control of temperature and of solution concentration is of first importance in commercial chromium plating. Automatic temperature controllers are usually employed and found satisfactory. There are various forms and types of temperature control in service in the United States for this purpose, of which an example is shown in the accompanying diagram.

Temperature Control

The operating range for the bath to be worked is determined and the controller is set to maintain this range to close limits. A good check thermometer should be used to occasionally check the automatic controller. In plating rooms shut down overnight, the bath may be



Courtesy Foxboro Company

Diagram of Recorder Installation in Chromium Plating Plant

brought up to temperature by the night watchman as a routine duty about one hour before starting the day shift. It is also satisfactory to keep the bath warmed overnight ready for use.

Correction for Thermic Mass of Work

On conveyor systems where large work is handled, a correction must be made to allow for the thermic mass of the new work fed into the bath. Sometimes this is avoided by previously heating the cathode work to about the temperature at which the chromic acid bath is maintained.

Chart Record of Work

In jobbing shops, it is a good plan to keep a brief chart record of the current density and temperature used on the variety of work handled, so that over a period of operation, a more or less standardized procedure proportioned to the characteristics of the bath used and peculiar factors of the plating system in service will be arrived at.

A year's record will materially assist daily routine on a variety of similar new work and can be kept simply on a form such as the one shown on the following page.

Solution Concentration

Whereas temperature may be automatically controlled, the automatic control of solution concentration is more difficult and as yet not generally practiced. Small operators rely on hydrometer readings, the appearance of the plated work, and occasionally a test check on the bath. Large plating rooms are usually subjected to careful check tests daily. Some plants have installed solution traps to return entrained bath content usually lost in spray to the bath. Dragout losses cannot be entirely avoided. The easiest replenishment is that required to make up for evaporation loss and it is usually accomplished by the addition of a diluted make-up solution in which the sulphate content used for the buffer agent is reduced below 50 per cent of the normal content of the bath used. The advantages of automatic solution control possible by the Edelman Automatic Control conductivity method have already been referred to in previous articles of this series. In this method, the conductivity of the bath is employed to regulate a control relay which operates an electrically driven control valve feeding make-up solution to the bath. An alternating current of small value is fed between control electrodes exposed to the bath solution for this purpose.

Accessory Appliances

A chromium plating shop should have at least a small equipment of testing appliances, titrating burettes, stock testing solutions of standardized strength, and a moderate supply of chemical analytical accessories. Electrical titration apparatus is preferred at some of the larger plants. It is pointed out that titrations are of little value unless accurately carried out. Suitable descriptions of methods and reagents and accessories required may be found in "Electrodeposition of Chromium from Chromic Acid Baths" Bulletin No. 346 of the U. S. Bureau of Standards, and in R. Schneidewind's "A Study of Chromium Plating," Engineering Research Bulletin No. 10, University of Michigan. The routine testing methods described in operating manuals issued in connection with exploited chromium plating processes are not at present available for publication but closely follow the same general principles as set forth.

Chemical Analysis

A detailed description of customary chemical analytical methods would require an outline extended beyond the scope of the present survey of the subject and the remarks will be here limited to mention of the most usual tests required for large operations.

Firstly, all reagent supplies are checked for purity and impurities. Also water supplies used are checked for possible variation of buffer acting content. Next the bath itself is checked for chromic acid content, and for chromium dichromate content as well as for buffer sulphate content. Checks on trivalent and hexavalent ion concentration are made by electrometric or chemical titra-

* Parts 1 to 8 were published in our issues for August to December, 1928, and January, February and March, 1929.

tions. Tests on contamination of the bath by dissolved iron or lead from anodes used may be made at more infrequent intervals. Any analytical chemist of average skill should be competent to carry out the necessary tests and titrations, and most of such tests are also within the capabilities of plating foremen of the higher type prevalent in the United States. Correct determinations of sulphate content in a used bath, however, require the skill of an experienced analytical chemist. Some of the process exploiting firms include analytical check test service in the general chemical engineering facilities offered with the technical process.

CHART RECORD

Work Plated	Current Density	Bath Used	Temperature	Time
Remarks on Deposits.				

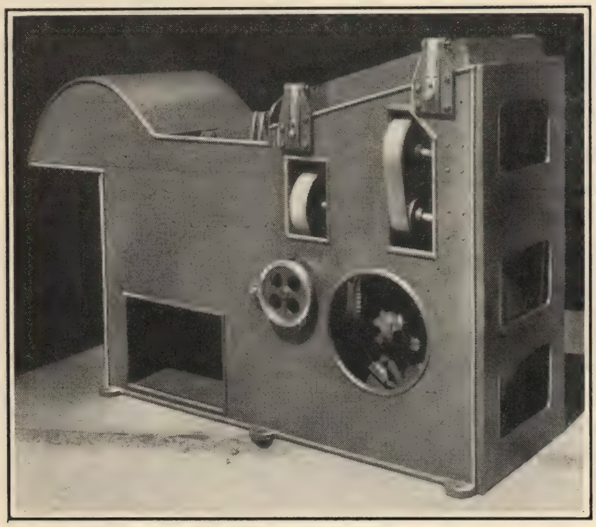
Form for Recording Chromium Plating Work

When a bath "goes wrong" it may sometimes be corrected by proper addition chemical. In any case, an effort should be made to at least locate the cause so that the mistake will not be repeated. The correction of a large volume of plating solution is a job for an experienced operator. In general the useful operating life of a chromium plating bath is much shorter than in the case, for example, of a nickel plating bath. One of the many reasons for this is the fact that the solution itself must furnish the metal content which is deposited without the aid of dissolving anodes of the plated metal.

This series will be continued in an early issue.—Ed.

Machine to Separate Work from Waste

The McKenzie Engineering Company, 352 Hope Street, Glenbrook, Conn., manufacturers of various types of special machinery, have placed on the market a machine for separating screw machine products from the chips formed in the operation of the screw machines. The equipment, shown in the illustration, is said to be capable of separating out a bushel of ordinary screw machine products in one minute. The machine will handle parts ranging from ⅛ inch to 2½ inches in diameter, including all descriptions of screws, bolts, nuts, wood screws, cartridge shells, etc. The latest model is said to be heavier, lower and with more solid frames than the older types, and has blast gate combined with blower.



Machine for Separating Work from Chips

The vibrator and self feeder are hung on swing brackets and driven with crank shafts. The machines are equipped either with motors or with countershafts, according to user's needs.

The machine is used after oil has been extracted from the mass of chips and products taken from the screw machine. The whole mass is thrown into the separator, an air blast is adjusted to blow according to size of product, and this feeds the material into a vibrator, where separation occurs, after which the products are removed. The makers claim one separator will take care of the output of 400 to 500 automatic screw machines.

Nitric Acid in Solution

Q.—By mistake we put nitric acid into our nickel solution. Can we overcome the effects of this in any way?

A.—There is no means that we know whereby nitric acid can be removed from a nickel solution without destroying the other constitutents that are necessary for the successful deposition of nickel. It is best to discard the solution and make a new one.

—OLIVER J. SIZELOVE.

Solution Analysis

Q.—Can you give me some data on the analysis of brass, copper, silver, and nickel solutions?

A.—A complete method for the analysis of the various plating solutions was published in the June and July, 1926, issues of THE METAL INDUSTRY.

"Principles of Electroplating and Electroforming," by Blum and Hogaboom, contains methods of analysis.

—OLIVER J. SIZELOVE.

Microscope for Brinell Tests

Paul F. Hermann Company, Keenan Building, Pittsburgh, Pa., has been appointed sole selling agent for a new type of microscope designed for use in connection with Brinell hardness testing apparatus. The new mechanism is known as the Busch-Schumann projector-type microscope for Brinell hardness testing machines. A bulletin recently issued by the Hermann company says, in regard to the apparatus, that the ever increasing use of the Brinell hardness test in industry has made it necessary to perfect the existing lens and measuring microscope devices, which are essentially adapted to laboratory use; or even to replace them by another instrument, which would afford in the hands of both employer and operator absolutely trustworthy measurements of at least the same degree of accuracy.

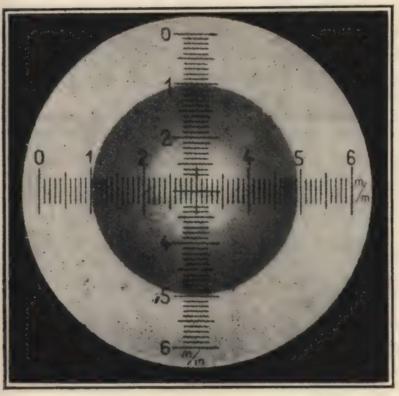


Fig. 1 — Photograph Showing Means of Measuring with New Brinell Hardness Testing Microscope

The lens and measuring microscope, it is stated, can be entrusted only to those skilled in taking the measurements, and that with these instruments the work needs especially good illumination which cannot always be easily had due to the position, shape or form of the object being tested. It is claimed that they have the further disadvantage of tiring the operator's eyes owing to the necessity of double focussing on scale and object.

With the Busch-Schumann device, it is claimed, the image of the Brinell ball impression, even when a lipped rim is produced, appears at once, magnified ten times and sharply focussed on a ground-glass screen as soon as the instrument is set up in the spot to be measured; so that the measurement can be read immediately and without trouble, with both eyes and with great accuracy; moreover the result, unlike that obtained with lens and measuring microscope appears with even edges and without any focussing.

With the light falling always perpendicular to the measured surface, the edge of the crater, unlike that produced with lens and microscope, is always revealed with equal sharpness of definition, even when the rim bulges, as the photograph of the ground-glass plate (Fig. 1) shows.

In consequence of the small size of the instrument, the measurement and testing of materials is now possible in places which are difficult to reach, where formerly reading with lens and measuring microscope were either difficult or had to be abandoned on account of the poor lighting. This type of measuring instrument altogether new, fulfills thoroughly all expectations and requirements, as has been proved by experience in numerous factories.

Its manipulation is stated to be simple, as shown in Fig. 2. The projector with its interchangeable lower part is set upon the surface to be measured. The illuminator in the instrument lights up the surface intensely. The image is projected through the built-in objective onto the ground-glass screen arranged above it, on which then two diameters of the Brinell impression can be read with an accuracy of 1/320 in., or greater with the help of the cross-scales on the ground-glass. The ground-glass with scale can also be rotated, so that now both diameters can be read quickly for any desired setting.

With a special device Brinell-ball-impressions may also be obtained of recessed surfaces or surfaces which are not plane. Also carrying a vertical ground-glass slide. This enables one without further adaptation to take satisfactory Brinell tests on the inner walls of hollow cylinders, with a minimum internal diameter of 8¾ in., or to make measurements in which readings on a vertical ground-glass slide are desired. In special cases the ground-glass images may be recorded photographically by the insertion of a photographic plate (size 3½" x 2½"); the necessary accessories for this purpose are supplied separately.

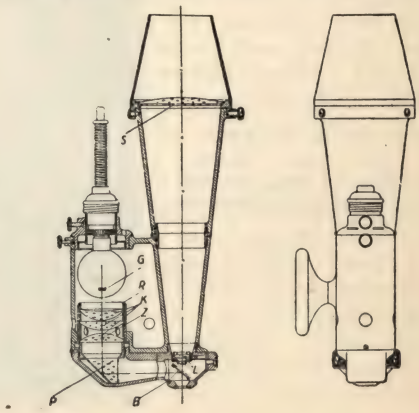


Fig. 2 — Diagram Showing How the Device Is Manipulated

The projector, furthermore, can be used for forgery examination of paper money and signatures, for the examination of paper and fabric products, counting of threads, in the watch industry, and for medical purposes, etc.

Brighteners for Nickel

Q.—We are writing to ask if you can give us some information regarding the use of brighteners in a nickel solution. Most of the brighteners now in use contain cadmium or some organic colloid, or a combination of the two.

Can a combination brightener as above cause the reduction of nickel sulfate to nickel sulfide with corresponding blackening of the work? We have heard that where a hot, agitated solution is operated, and especially when a high acid content is maintained, such a result can happen.

A.—As you state, most of the brighteners used for nickel solutions contain cadmium or organic colloids, and if free of sulphur, it would be impossible to form nickel sulphide.

An excess of these brighteners when added to a nickel solution will cause a dark deposit, but if used carefully and for special work, excellent results can be obtained. All brighteners have a tendency to produce hard deposits and this factor must be taken into consideration when using them. —OLIVER J. SIZELOVE.

Foundrymen's Meeting in Chicago

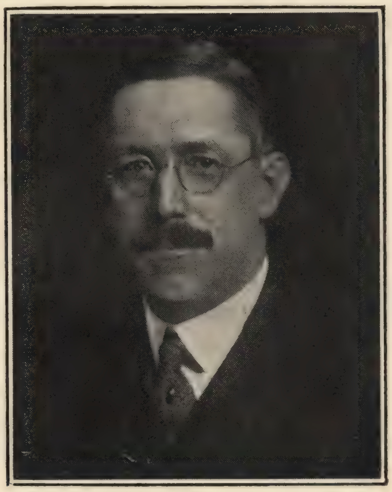
A Report of the Thirty-third Annual Meeting of the American Foundrymen's Association in Chicago, Ill., April 8-11.

The spring meeting of the American Foundrymen's Association was held at the Stevens' Hotel in Chicago. The program which was published in our March issue, provided a great deal of interesting material and discussions.

Non-Ferrous Cost Methods

In the session on non-ferrous foundry costs, J. L. Wick, Jr., chairman of the sub-committee, outlined a program for the members present. He specified a mixture of virgin metal, allowing for 50 per cent foundry returns, and called for cost estimates from his audience. The answers varied from 30.25 cents to 56.76 cents per pound.

Some interesting figures came out in the discussion.



N. K. B. Patch
Newly Elected Vice-President of the American Foundrymen's Association

The conversion charge for fuel, melting room labor, taxes, repairs, etc., ranged from $1.32 to $4.00 per 100 pounds of metal. There was considerable discussion on the allowance for metal losses, estimates ranging from 1½ per cent to 5 per cent, melting in various ways.

The following is a table of cost figures submitted by Mr. Runge, for the problems submitted to the audience.

Cost (before adding profit) of 100 Pounds Brass Castings.

	The Example		An Average According to Runge
Copper	85 per cent @	$0.25	$25.81
Tin	5 " " "	.50	
Lead	5 " " "	.08	
Zinc	5 " " "	.08½	
Conversion			2.00
Molding labor		2.00	2.00
Molding expense			4.00
Core labor		.50	.50
Core expense			.75
			$35.06

Brass Foundry Practice

H. J. Roast of the National Bronze Company, Montreal, Canada, told of some of the methods used in moulding a large architectural bronze door, 4′ x 13′ x ¼″ thick with large panels. He pointed out that it was more practical to cast this in several panels than to attempt to make a single casting of the whole piece, because of its great area and small thickness. The composition of the metal was 85 copper, 10 zinc, 5 tin. The mold was made of new French sand and faced with old French sand, requiring two and a half days for drying in an oven. It took the labor of two men and a helper for twelve days to make this mold.

The method of pouring was to run the molten metal in from five reservoirs with runners leading to the center of the panels, in addition to the usual runners. Five risers were used opposite the reservoirs. The mold was inclined about 2″ to the foot. The metal was heated up to 2300° F., and poured at about 2150° F.

Mr. Roast discussed another problem, that of making mirror frame grills of "white bronze." A satisfactory mixture was found to be 25 tin and 75 lead. He also touched on other problems, such as the making of a combination shoe horn and buttonhook of manganese bronze; the high strength requirements demanded such a high grade mixture.

Electrical Melting

J. B. Meier of the F. H. Foundry Company, Newark, N. J., described the operation of electric arc furnaces in his jobbing foundry. The work was of a semi-production character, consisting of plumbers' brass of fairly thin section, that is, 3/32″ to 1/16″. Pouring temperatures were about 2100° to 2200° F., the metal being largely the 85-5-5-5, mixed in the proportion of 2 parts ingots, 1 part scrap and 3 parts gates. He found his electric melting costs to be $20.50 a ton including metal losses as against $31.10 a ton for fuel oil.

Shop Practice

A round table luncheon and discussion devoted to general non-ferrous shop practice was held, with J. W. Bolton of the Lunkenheimer Company, Cincinnati, Ohio, as chairman. As usual, this luncheon brought forth a free interchange of opinion, the discussion covering various specialties, such as aluminum, brass and bronze castings, etc. The meeting continued until late in the afternoon.

Foreman Training

A. D. Lynch, personnel director of the Ohio Brass Company, Mansfield, Ohio, read a paper on Foreman Training, in a symposium. He pointed out that foremen should be as informed fully as possible about the facts and policies of the company; meetings to be held at regular periods, preferably out of regular working hours. Mr. Lynch dwelt on some of the factors with which the foreman must be familiar, such as plant maintenance, safety, economy of operation, proper placement and delegation of work. He must be an example and leader to his men.

Prize Awards

The Joseph L. Seaman Gold Medal was awarded posthumously to the late Jesse L. Jones. The presentation was made by G. H. Clamer, and the medal received by Mrs. Jones.

An award was made to O. W. Ellis for his paper on "The Effect of Lead on the Properties of a Complex Brass." Mr. Ellis was recently in the Research Department of the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. He is now with the Ontario Research Foundation, Toronto, Canada.

BRASS WORLD

AND

Plating — Polishing — Finishing

Published Monthly by

THE BRASS WORLD PUBLISHING COMPANY, INC.

11 Cliff Street, New York . Telephone, Beekman 2306

SUBSCRIPTION RATES

Domestic, one year, $1.00. Canadian, one year, $1.50. Foreign, one year, $2.00. Single copies, current issue, 10 cents each.

ADVERTISING RATES ON APPLICATION

Issued about the 25th of each month

Forms close on the 15th

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Spotting Out

THE season of the year is approaching when we shall be visited by one of the worst enemies of the plating shop—spotting out. This evil may befall anyone at any time but it is particularly prevalent during the humid summer months. For that reason it is especially timely that a report has been issued by W. P. Barrows of the Bureau of Standards on his research into spotting out which he conducted for the Research Fund of the American Electroplaters' Society. (See page 79 of this issue).

To eliminate spotting out entirely is practically impossible at this time. It is caused primarily by certain factors outside of the control of the plater. For example, metal with an imperfect surface will spot out readily; work plated in alkaline solut[illegible]iarly susceptible to spotting out. It is, howeve[illegible] keep down the incidence of this trouble-maker [illegible] hold it within "reasonable" bounds. Crystal spots can be held to a minimum by the use of the correct lacquers; the use of wax paper for wrapping; the addition of an oil film on plated surface. Stain spots can be controlled to a very large degree by carefully checking the parts to eliminate those with excessive porosity; by not grinding down into the blow holes which are generally present under the surface of castings; by the use of the correct lacquer after plating and finishing; and last, but possibly most important, by allowing work to stand after plating, but before finishing for at least twenty-four hours. During this time the work spots out excessively, but these spots can be removed by the proper dip and the pieces then properly finished.

Mr. Barrows' work has been exceedingly valuable. Not all of his conclusions are altogether unknown, as many, in one form or another, may have been mentioned or brought to the attention of the plating industry before he took up his research. However, before his work, information on this subject was helter-skelter and the knowledge of spotting out was in chaotic condition. There were many suggested remedies and no definite information. Now we have the facts carefully prepared and collected, and checked against laboratory tests and operating records. Further improvements undoubtedly will be made in the prevention of spotting out but it is highly probable that such progress will have to be based upon the work of Mr. Barrows and begin where he left off.

Electric Melting in the Foundry

THE old question has been brought back—"Is the electric furnace practical in the jobbing brass foundry?" Arguments have been thrown back and forth for years and so far the answer seems to be the ambiguous statement that where it is not practical, it is not practical; where it is practical, it is practical. In other words, local conditions determine the choice to be made in every case.

A comprehensive paper read at the Chicago meeting recently held by the American Foundrymen's Association, discusses this question in great detail, laying special emphasis on operation, maintenance and costs,. According to J. B. Meier the total cost of electric melting of brass in his jobbing foundry, in the arc furnace, was a maximum of $14.74 per ton, not counting metal losses; with metal losses it was $20.50 per ton. Similar figures using, oil as a fuel, in his foundry, showed $17.50 per ton and $31.10 per ton.

Our readers will be interested in checking these figures with their own costs, using either fuel. We should be glad to throw our columns open to any comparisons reported to us.

Questions and Answers

All inquiries are answered in the order received and, whenever possible, the answers published in the next regular issue

Analysis of Chromium Solutions

Q.—I have been a plater for many years and have always realized the necessity of keeping up with the technical progress made in the art of electroplating. For this reason, I took a course in chemistry some time ago and learned a good deal about analysis and other simple procedure in the chemical end of the work. However, the course was short and it by no means made a plater out of me, and for this reason I have struck a few snags in trying to analyze chromium solutions. If you will be so kind as to outline a few points for me, I think I shall be able to do the analytical work more perfectly.

Perhaps it might be better if I merely asked you how to analyze a chromium solution instead of asking a number of questions that might amount to the same thing.

I have Technologic Paper No. 346 of the Bureau of Standards.

A.—You state that you have Technologic Paper No. 346 and I believe that this paper contains the correct method for the analysis of a chromium solution. The method as outlined is accurate, but is a little more difficult than the analysis for some of the other solutions.

There is no simple test for the chromic acid content unless you use the hydrometer and from the specific gravity calculate the ounce per gallon. The government paper also contains a chart for this test.

—OLIVER J. SIZELOVE.

Barrel Plating

Q.—In using a barrel for electroplating of small parts, what is considered a normal speed of rotation? We are particularly interested in electrogalvanizing.

We presume that it is not advisable to move the parts in the barrel too much.

A.—For very small articles that would have a tendency to nest, that is, not to turn over, 5 to 6 revolutions per minute would be necessary. Most speeds of rotation that we have seen have been 3 to 4 revolutions per minute.

—JOSEPH HAAS.

Choice of Silver Solution

Q.—We expect to make a change in our silver solutions and would be pleased to have you tell us whether in your opinion it is better to use solutions of silver chloride or of silver cyanide.

A.—Silver chloride is a salt that, before the advent of silver cyanide, was always used for silver plating. It is still used, and from our knowledge it is being used entirely without trouble.

Silver cyanide is analagous chemically to silver chloride, except that it contains cyanide in place of chlorine attached to the silver.

In our estimation, your decision to use either of the two will be dependent upon whether you have a good plater. A good plater will obtain perfect results with either. Bear in mind that an initial formula is not as important as the handling and manipulation and maintenance of the solution if you are to get good results.

—JOSEPH HAAS.

Choice of Chromium Solutions

Q.—I have found your information very invaluable in the past and now that I am thinking of expanding my works by the installation of a chromium bath, I am again applying to you for help. I would highly appreciate your advice as to which of the two following solutions I should use. My tank will be about 13 feet long, 2 feet wide and 2½ feet deep.

Solution No. 1:

Water	1 gallon
Chromic acid	20 ounces
Chromic sulphate	1 ounce
Boracic acid	¾ ounce
Chromate of iron	1 ounce

This solution would be used with chrome steel anodes and no protection against gases emitted at the cathode.

Solution No. 2:

Chromic acid

Sulphuric acid

This solution would be used with lead anodes and with protection against gases emitted at the cathode.

Is solution No. 1 practical today, or would you advocate the use of the second?

A.—We would advise you to use solution No. 2 in the following proportions:

Chromic acid	55 ounces	
Sulphuric acid	0.3 ounce	by weight
Water	1 gallon	

Use 6% antimonial lead for anodes. Operate the solution at 95° F., with an anode current density of 33 amperes per square foot.

Provide ample means to exhaust all gases. Use a glass-lined iron tank.

—OLIVER J. SIZELOVE.

Cleaning Copper

Q.—Will you please inform us what would be the best method of cleaning copper which is in a completed form and which we desire to finish up with a solution which will allow us to grain with steel wool or emery? At the present time we are experiencing difficulty in cutting into the metal with steel wool or emery in the condition they are now in, which is a corroded crust that forms on the copper.

A.—We assume your copper is in the form of castings. These should first be pickled in a warm solution of

Sulphuric acid	1 quart
Water	1 gallon

To every 10 gallons of the above solution add 1 pint of hydrofluoric acid. The solution above should be contained in a cypress wood tank which has been lead lined with joints "lead burnt." After soaking in the above solution 10 to 15 minutes in order to loosen the sand, the castings are removed and bright dipped. The bright dip solution is composed of

Nitric acid	3 gallons
Sulphuric acid	4 gallons

In mixing the acids pour the sulphuric into the nitric. First place a jar with nitric acid in a tank of cold water. Add the sulphuric slowly and only at intervals, as considerable heat is evolved. After bright dipping, rinse in cold water and then in hot water to dry.

—Joseph Haas.

Coatings for High Temperatures

Q.—In a recent article on oxidized brass for high temperature you mention the use of a solution of sodium silicate as a protective coating over brass when used around gas heat. We have been using silicate of soda on sheet brass and brass plated castings for the last year and have been experiencing considerable trouble with the coating turning white or blooming.

We would appreciate it very much if you would tell us some method by which we could eliminate this trouble.

A.—We are aware of no material used as a protective coating that will successfully withstand the high temperature produced by a gas flame. The sodium silicate solution referred to will give as good results as any.

If the gas flame does not come in direct contact with your product, you might try Bakelite lacquer. This material will withstand a temperature of 275° F. without charring.

—Oliver J. Sizelove.

Data on Nickel Finishes

Q.—I have a nickel solution that has been used for plating die cast work. It gives good results on the die cast articles but in trying to use it for brass it has proven not so good. Can you tell me if the solution should be built up a little to make it suitable for brass, or if that would not be wise? If not, what is a good solution for plating brass work in a conveyor apparatus?

Do you know of any chemical method of coloring to produce a black finish on nickel but with highlights that are relieved and with black left in the backgrounds?

How can I prevent white spots (and sometimes red spots) that appear on low brass boxes that have been acid dipped? The spots appear after a day or so. I dry them in hard wood sawdust.

What solution can I use for obtaining a dark or black oxidized finish on brass boxes without copper plating? I want to dip the boxes in the solution to blacken them and then relieve with wire brush.

A.—A nickel solution that is made especially for die cast work will not give as good results on brass work as one that is made to plate brass work. The metal content is lower for die cast work and the other constitutents are changed somewhat. We would not recommend building up the solution if it is used for die cast work, as trouble will then be encountered in plating the die cast work. For plating brass work use the following solution.

Double nickel salts	8 ozs.
Single nickel salts	4 ozs.
Boric acid	2 ozs.
Ammonium chloride	2 ozs.
Water	1 gal.

There is no chemical coloring method that we know of whereby nickel can be made black and the high lights relieved and the black left in the back ground. We would suggest that you use drop black thinned with turpentine to right consistency. Paint the articles, and when dry relieve the highlights with a rag or piece of felt moistened with turpentine.

If the white and red spots that you refer to are not due to the condition of the dip, we believe the sawdust is at fault. Clean hardwood sawdust should be used for drying. Send us a sample for inspection.

Brass articles can be blackened in the following solution:

White arsenic	2 ozs.
Sodium cyanide	8 ozs.
Ammonium hydroxide	1 oz.
Water	1 gal.

Use hot. Relieve with a tampico or rag wheel, using pumice stone as the abrasive.

—Oliver J. Sizelove.

Bright Nickel Deposit

Q.—We are sending samples of two nickel solutions that have been giving trouble and articles plated with these solutions. The process we use in plating these articles is as follows:

Articles are run in sawdust until excess grease is removed, then placed in an electric cleaning solution for half an hour, then thoroughly rinsed before placing in plating solution. We have also tried burnishing in a cleaning solution for three or four hours, but the result has been no better. Then we place the work in the plating barrel and plate for one hour at 6 volts. When removed from the barrel, the work is dark or stained, even before immersion in clean water or sawdust for drying. We have tried a copper strike before nickel plating, but the nickel deposit still comes out dark and stained.

What we want is a clear deposit of bright nickel, one that will not need an excessive amount of tumbling in sawdust to polish it. Can you tell us what is wrong with our solution or method?

A.—Analysis of nickel solutions:

No. 1.—Metallic nickel	7.18 ozs.
Chloride, as ammonium chloride,	2.98 ozs
pH	6.2
No. 2.—Metallic nickel	7.26 ozs.
Chloride as ammonium chloride	1.84 ozs.
pH	6.6

Both solutions are quite high in metal, we would suggest that they be reduced ⅓. Add ½ oz. of cadmium chloride to each 100 gallons of solution. An excess of this salt must be avoided as it produces a brittle deposit.

Your method of preparing the work for a bright finish is entirely wrong. We would suggest that the work be bright dipped and then burnished with steel burnishing balls to produce a bright finish before nickel plating.

—Oliver J. Sizelove.

Hardness of Chromium Deposits

Q.—I have been following your journal, especially on chromium, for a long time. Lately I have encountered some problems and am applying to you for information.

There seems to be quite a bit of difference of opinion as to the hardness of chromium plate so far as scratchbrushing and friction are concerned, when the plate is applied to a polished brass surface. Will you kindly answer the following questions?

Is there a noticeable difference in the chromium plates produced by various formulas for solutions to be used on polished brass surfaces?

Do you know of any one solution that will throw a harder plate than all the others? The hardness, of course, is judged by scratchbrush and friction tests on polished brass, with a deposit produced by plating, for example, one hour.

What governs the degree of hardness of a chromium deposit?

Has heat any effect on a chromium deposit as to temper? For example, if I were to plate a brass casting for one hour, then heat the piece to 500° F. and quench it quickly in salt water, would the plate become harder than it was when taken from the plating bath?

At present I am using the following formula:

Chromic acid	55 ozs.
Sulphuric acid	0.5 ozs.
Water	1 gal.

Temperature, 110° F.

A.—We do not believe that the composition of the solution has any bearing on the hardness of the deposited chromium; at least we do not know of any facts brought out to that effect. Your solution as stated is a satisfactory one. We do know, however, that current density and temperature influence or govern the hardness of deposited chromium, the hardest deposits being produced at relatively high current densities at a temperature of 110° F. At 150 amperes per square foot and 110° F., maximum hard suitable deposits are obtained.

Heat has no effect upon deposited chromium in the manner indicated by your inquiry, that is a property of steel and steel alloys. What heating will accomplish, however, is to drive out occluded hydrogen, thereby relieving your deposit of any brittle effects.

—Joseph Haas.

Inexpensive Copper Finish

Q.—We have several hundred brass plated iron handles which we wish to cover with copper, and would appreciate your suggestions as to the quickest and cheapest method of covering them with copper surfaces to match copper trim on cedar chests.

We have tried lacquering with a gun, but it is necessary to keep them apart and put them on racks, and therefore is not very satisfactory. We thought possibly you could give us a simple method of plating them.

A.—You have a mistaken idea of the possibilities of electroplating. Unfortunately, the plating industry has not yet reached the "Aladdin's Lamp" stage. Articles to be plated must be racked when their nature requires it. Some may be placed in a tumbling barrel, where the motion of the barrel gives enough separation to permit even deposition. Where spray finishes are the practice, one cannot dump them in a mass upon a table and spray them with any sort of uniformity. They either have to be racked or spread out.

We recommend that you remove the brass plate, if you have the equipment, by tumbling in a barrel with pumice stone or ashes. In another barrel, tumble with steel balls to brighten. Then place the handles in a basket and immerse in the following solution:

Copper sulphate	6 ozs.
Water	1 gal.

Add 1 fluid oz. sulphuric acid to every 5 gallons of this solution.

Shake the articles up well in the basket. Rinse in cold water thoroughly and then in hot water, then lacquer in "water dip lacquer." Then dump out upon a screen and spread out to dry. Water dip lacquer and its manner of use can be obtained from lacquer manufacturers advertising in Brass World.

Joseph Haas.

Natural Steel Finish

Q.—How can I dip steel and iron to get a bright natural finish, somewhat crystalline? I have tried muriatic acid but the effect is very slight, although along the right line. Will you please outline the complete process for this work.

A.—The iron or steel should be cleaned in an alkaline cleaner to remove any oil or grease. It is then pickled in a hot concentrated hydrochloric acid bath to remove any rust or tarnish. Then it is passed through a dip made of 2 parts sulphuric acid to 1 part nitric acid. To every 5 gallons of this dip, add 1 oz. of metallic zinc. When cool the dip is ready for use.

Rinse thoroughly in clean cold water after dipping and if surface of metal is not white enough, place in a hot cyanide dip, 8 ozs. of sodium cyanide to 1 gallon water, for a few minutes. Rinse thoroughly in clean cold water, then in hot water, and dry in hardwood sawdust.

—Oliver J. Sizelove.

Neutral or Acid Silver Solution

Q.—We have had occasion to do some silver plating on a piece of apparatus we are using in our laboratory, and we have come to the conclusion that if we could carry out the plating in a neutral or acid solution, the result might be better. If you know of any such, instead of the usual alkaline cyanide bath, we would appreciate very much some information regarding it.

Are there any silver plating solutions that will work in a neutral or acid bath?

A.—It is difficult to imagine conditions under any circumstances either practical or experimental in which satisfactory deposits of silver could not be obtained from cyanide solutions. It is too bad that you did not mention in what way your deposits of silver from the cyanide solution were unsatisfactory. All attempts to plate silver from acid or neutral solutions have given deposits much inferior to those obtained from cyanide solutions.

—Joseph Haas.

Nickel Solution in Poor Condition

Q.—Several months ago I asked you how to remove copper that had gotten into a nickel solution. Following your directions, I removed the copper. However, although the solution is plating white and the plate stands coloring, the solution has a coppery or rusty scum on the surface. This scum clings to everything put into the tank. It can be skimmed off, but in half an hour a new scum forms as bad as the one removed. I have tried removing the solution and cleaning the tank. There is always a rusty

looking mud at the bottom. However, this does not help much.

I have a lead steam coil for heating the solution. The rust or whatever it is clings and crusts on this coil also. I have been unable to get more than 2 ozs. of nickel to stay in the solution. Any excess of nickel drops to the bottom. The anodes become dirty and must be cleaned also.

The solution was made up with double nickel salts. If more salts are needed, would it be better to add single nickel salts? I am sending a sample of the solution for your analysis. Please tell me if it is possible to reclaim the solution. I have a set of comparators which I use.

A.—Analysis of nickel solution:

Metallic nickel	1.08 oz.
Chloride as ammonium chloride	0.14 oz.
pH	5.2

Solution is in very poor condition. The metal content is low, there is practically no chloride, and the pH is also too low. The solution also contains a large amount of iron, and it is this element that causes the scum to form on top of the solution.

To correct the solution, add enough ammonium hydroxide to bring the solution to a pH of 6.2. Most of the iron will be precipitated. Stir the solution thoroughly, let it stand for a day, filter the solution, and to each gallon add 5 ozs. single nickel salts, 2 ozs. sodium chloride and 2 ozs. boric acid. Then bring the pH to 5.8 by the addition of sulphuric acid.

It would be about as cheap for you to discard the solution and make a new one. If you care to do this, use the following formula:

Double nickel salts	8 ounces
Single nickel salts	4 ounces
Boric acid	2 ounces
Sodium chloride	2 ounces
Water	1 gallon

—Oliver J. Sizelove.

Pompeian Green Finish on Brass

Q.—I am sending you an illustration taken from a pamphlet of the Taunton-New Bedford Copper Company, Taunton, Mass. This picture shows a Grecian bronze helmet of the sixth century B. C. which was excavated in France some time ago. I would like to duplicate the beautiful finish which the colored illustration shows on this helmet and wonder if you could give me directions for doing so. I wish to have the simplest possible method.

Also, please outline a method of producing an oxidized copper finish on steel articles such as jewelry boxes. All prominent surfaces of these articles are polished.

A.—The illustration submitted as a sample shows what is known as the Pompeian Green finish. To duplicate it, proceed as follows: after bright dipping your yellow brass articles, stiple with a painter's sash brush with the following solution.

Acetate of copper	4 ounces
Ammonium chloride	1 ounce
Ammonium sulphate	2 ounces
Zinc sulphate	2 ounces
Water	1 gallon

Rub the solution in well and then, with a second brush that is slightly wet with the solution, stiple lightly. Hang up to dry for 10 to 15 minutes. By that time a thin skin of green should have formed. Then run the articles through cold, clean water. Shake off excess water and allow to dry for 2 to 3 hours. Then take about a half a pint of the above solution and dilute it four times with water. Add about 2 fluid ounces of liquid ammonia. With a brush slightly damp with this diluted ammonia solution, stiple lightly over the articles. Allow to dry again for two or three hours and then lacquer. After that, brush up with wax.

To produce oxidized copper solution upon steel articles, plate in a cyanide copper solution of the following composition:

Copper cyanide	4 ounces
Sodium cyanide	4 ounces
Sodium carbonate	2 ounces
Water	1 gallon

If at all possible, use the solution warm at about 120° F., and operate with a voltage of 2 to 2½. In 15 or 20 minutes you will have sufficient copper deposited to blacken in the following solution:

Water	1 gallon
Sulphuret of sodium	½ ounce

Then rinse first in cold water and then in hot water to dry, after which dry scratch brush lightly, and with a cotton buff to which rouge has been applied, bring out copper spots (called shading) as desired.

—Joseph Haas.

Porosity Affects Nickel Deposit

Q.—I am sending you a casting which shows a red stain which does not seem to cover with nickel. I have been told that this stain is brass showing through the deposit. I have held the casting in the tank ten minutes extra but the stain will not cover with nickel. What do you think of it?

A.—The red stain on your casting is due to the porosity of the casting. If examined under a magnifying glass, these small holes are readily seen.

If you use an acetic acid dip after the alkaline cleaning operation and transfer immediately to the nickel solution, you will avoid these red stains.

The acetic acid dip is made by adding 4 ozs. of acetic acid to each gallon of water. Let the castings stay in this dip for 2 or 3 minutes.

—Oliver J. Sizelove.

Temperature of Solution

Q.—I am sending you a sample of a solution made with double nickel salts which has been giving me trouble by producing a deposit that peels. I would like to know about the acidity, metallic content and conductivity of this solution before I start to doctor it in any way. It is an old solution and may be somewhat dirty. It has seldom had any other additions than double nickel salts. Please give me your opinion as to this solution after analysis.

A.—Analysis of nickel solution:

Metallic nickel	2.47 ozs.
Chloride, as ammonium chloride	2.52 ozs.
pH	5.8

Analysis shows your solution to be in good condition. We believe that the trouble you have with the deposit raising is due to the temperature of the solution. Raise temperature to 75° to 80° F., while plating. Also, look to the cleansing of the work before plating.

—Oliver J. Sizelove.

Associations and Societies

American Electroplaters' Society

New Branch at Los Angeles

HEADQUARTERS, CARE OF M. D. RYNKOFS, 1350 WEST 25th STREET, LOS ANGELES, CALIFORNIA

A charter to form a Los Angeles Branch of the American Electroplaters' Society has been requested by more than twenty-five platers in the Los Angeles district who held a meeting on February 4, 1929, for the purpose of organizing and requesting the charter. The meeting was held at the Los Angeles Y. M. C. A., and following the discussion of the business of forming the Branch, a technical session was held at which papers were read on the subjects of Cadmium Plating and Electroplating on Aluminum. Lively discussion following the papers.

The men who are organizing the branch at Los Angeles wish all platers and finishers in California and adjacent territory to feel free to join them and gain the benefits that have accrued for years to the members of the Middle Western and Eastern platers who have been members of the American Electroplaters' Society. Any who wish to join or to get further information may address the secretary at the address given above.

A second meeting of the temporary Los Angeles Branch was held on April 10, when 29 men attended a dinner at the Y. M. C. A., and then held a technical discussion. The meeting was presided over by **Clarence Thornton**, temporary chairman, while the technical session was in charge of **Charles Russell.** Metal cleaning was the principal topic of the evening. **P. A. Boeck** of the Oakley Chemical Company gave a comprehensive talk on this subject, explaining the action of cleaners which and without electric current, and the effects of direct and reverse currents. Several of those present testified to the value of the copper cleaner strike, by means of which they were able to overcome serious cleaning troubles.

It is expected that a permanent charter for the organization of this branch will be received from the Supreme President of the Society shortly, after which an open smoker meeting will be held.

Bridgeport Branch

HEADQUARTERS, CARE OF WILLIAM EHRENCHRONA, 872 HANCOCK AVENUE, BRIDGEPORT, CONNECTICUT

The Bridgeport Branch of the American Electroplaters' Society, as previously announced in these columns, holds its eleventh annual educational session and banquet on Saturday afternoon and evening, April 27, 1929, at the Hotel Stratfield, Bridgeport.

The educational session will start at 2:30 p. m. and will be presided over by Charles H. Proctor, founder of the Society and an associate editor of THE METAL INDUSTRY. There will be a number of important papers on several subjects of great interest to all platers, chemists and metal finishers, as well as plant executives, manufacturers and others of similar interests.

The banquet will take place in the evening. The chairman of the banquet committee, R. J. O'Connor, 1228 Noble Avenue, Bridgeport, Conn., will appreciate early communications from all who expect to attend, stating the number in each party and all other pertinent matters.

—THE BANQUET COMMITTEE.

Detroit Branch

HEADQUARTERS, CARE OF CHARLES PHILLIPS, 13421 CAMDEN AVENUE, DETROIT, MICHIGAN

The American Electroplaters' Society Convention Committee at Detroit has arranged to have a fine badge for each member who attends the convention, to be held at the Hotel Statler, Detroit, July 8 to 11, 1929. The badge consists of a fine medal showing a background of buildings, ships and overland traffic, with the seal of Michigan overlaid, all in heavy relief. There is a red, white and blue ribbon, a holder for name card, and a fine metal and enamel button with the insignia of the Society, attached to the ribbon. This button can be removed from the ribbon and worn as a permanent memento of the convention, as well as a sign of membership in the Society.

Personals

Clark S. Judd has been elected vice-president of the American Brass Company, Waterbury, Conn.

John C. Pangborn, vice-president of the Pangborn Corporation, Hagerstown, Md., and his family, sailed on the S. S. Olympic, Friday, April 5th, for an extended tour on the continent.

J. E. Watson has been made secretary and director of the Pittsburgh Die Casting Corporation, Pittsburgh, Pa. He is also vice-president and general manager of the Elliott Company, Jeanette, Pa.

O. D. Conover has been elected vice-president of the Foundry Equipment Company, Cleveland. Mr. Conover has had wide experience as an engineer in foundry production and construction work.

Howard E. Batsford, who was designing engineer in the research department of the Rome Wire Company, has accepted a position as development engineer for the American La France and Foamite Corporation.

Henry Johnson, formerly identified with the Westcott Valve Company, East St. Louis, Ill., has been appointed foundry superintendent of the Pittsburgh Valve, Foundry and Construction Company, Pittsburgh, Pa.

C. A. Barnett has been elected president of the Foundry Equipment Company, Cleveland, Ohio. Mr. Barnett has been connected with this company since July, 1916, holding offices of treasurer, vice-president and general manager.

A. V. Wadsworth has been elected vice-president and general manager of the Pittsburgh Valve and Foundry Construction Company. He was formerly manager of the Westcott Valve Company, East St. Louis, Ill.

Edwin P. Root has been elected chairman of the Board of Directors of the New Haven Clock Company,

New Haven, Conn., after fifty-four years in the service. He was formerly president. Mr. Root is succeeded as president by **R. H. Whitehead,** formerly vice-president of the company.

A. A. Grubb is now engaged in research work at the California Institute of Technology, where he is doing work on colloids and expects to extend the investigation to particle sizes over the whole range found in clays. He was formerly with the Ohio Brass Company, Mansfield, Ohio.

H. L. Parr announced his resignation as general manager of the Burgess-Parr Company, Moline, Ill. No immediate successor will be named but it is announced that manufacturing activities of the company and its policies will continue as at present. Professor W. S. Parr is president of the concern.

Fred D. Baker has become associated with Charles H. Besley and Company, Chicago, Ill., as sales engineer, and will have charge of the sale of Besley grinders and Titan abrasive disks in the Cleveland, Erie and Buffalo districts. Mr. Baker was formerly with the Strong, Carlisle and Hammond Company, Cleveland.

Evarts C. Stevens was elected vice-president of the International Silver Company, Meriden, Conn., and with Craig D. Munson was elected a member of the executive committee. Mr. Stevens will also be in charge of the manufacturing operations in all plants of the company. Other officers of the company were re-elected.

Charles A. Anderson, Jr., has been elected president of the Pittsburgh Valve Foundry and Construction Company, Pittsburgh, Pa. He has been connected with the company for twenty-one years, working in the production, purchasing and sales departments. His last position with this company was that of vice-president.

Ellis E. Edwards has joined the International Chemical Company, Philadelphia, Pa., as sales engineer in the Wisconsin territory. Mr. Edwards is a graduate of Oberlin College and has been actively engaged in the metal industry for the past fifteen years, and is well versed in latest developments in metal lubrication, finishing, and cleaning.

Paul E. McKinney has resigned and has been appointed metallurgical engineer for the Bethlehem Steel Company, Bethlehem, Pa. He was formerly chemist and metallurgist for the United States Naval Gun Factory, Washington, D. C., where he was in charge of the foundry for many years. Mr. McKinney is widely known for his work in connection with high-strength castings and forgings in both steel and bronze.

E. P. Boyer, since 1919 identified with the activities of The Alexander Milburn Company, Baltimore, Md., manufacturers of spraying, welding and other industrial equipment, has been elected a vice-president of the company. Mr. Boyer's first connection with the Milburn firm was in the capacity of Philadelphia district manager. He established the Milburn Sales Company in 1926, which at first took over the Philadelphia sales of Milburn products and later entered the New York and Chicago fields. Later, in 1928, Mr. Boyer was elected a vice-president of the Milburn Sales Corporation and the Milburn Paint Spray Corporation, which are the distributors of all the products of The Alexander Milburn Company. Mr. Boyer is now spending a large part of his time at the Baltimore offices of the company.

Business Reports in Brief

Brass Specialty Company, Hamilton, Ont., Can., plans the construction of a plant there.

Hershey Metal Products Company, Derby, Conn., will build a one-story addition, 56 x 100 ft.

Magee Copper Company, Bloomsburg, Pa., awarded contract for a four-story, 75 x 280 ft. spinning plant. Estimated cost $300,000.

Algonac Brass Foundry, Algonac, Mich., has changed its name to Algonac Foundry Company. W. E. Warner is president.

The Carborundum Company of Niagara Falls, N. Y., has opened the New Carborundum Building at 2758 E. Grand Boulevard, Detroit, Mich.

Waukegan Foundry Company, North Chicago, Ill., Twenty-second Street and Commonwealth Avenue, suffered damages by fire recently.

Preas Metals of America, Inc., Marysville, Mich., has asked bids on revised plans for a two-story addition to cost about $40,000 with equipment.

Patton-MacGuyer Company, Baker Street, Providence, R. I., manufacturers of brass goods, awarded contract for a one-story, 80 x 160 ft. factory.

The Atlas Brass Foundry, 1901 Santa Fe Avenue, Los Angeles, Cal., has purchased some ground adjoining its property to be used for extension.

Viking Pump Company, Cedar Falls, Iowa, is planning a merger with the Falls Foundry Company and the Banner Brass Company, both of Cedar Falls.

C. & G. Foundry and Pattern Works, 1020 Kentucky Avenue, Indianapolis, Ind., have purchased the United Brass Works, Jones and Harding Streets.

National Bearings Metal Company, Norfolk, Va., plans the construction of a plant addition for the manufacture of brass castings and bearing metals.

Victor Metal Products Corporation, 196 Diamond Street, Brooklyn, N. Y., will soon take bids for a two-story addition to cost about $30,000 with equipment.

Cheney Company, Melrose, Mass., manufacturer of wall flashing and kindred metal products, has acquired a two-story factory at Winchester, Mass., for a new plant.

Bridgeport Brass Company, Bridgeport, Conn., is having plans prepared for a one-story, 75 x 200 ft. brass rolling mill on Housatonic Avenue. Estimated cost $40,000.

Western Clock Company, Hunter Street, N., Peterborough, Ont., Can., plans the construction of a four-story, 80 x 200 ft. addition to its factory. Estimated cost $100,000.

Clem Duncan Foundry has succeeded the **Master Carburetor Company,** 3020 South Main Street, Los Angeles, Cal. It will make brass, bronze and aluminum castings.

Novelty Ornamental Iron and Wire Works, Seattle, Wash., has announced plans for a new brass foundry at the southwest corner of 11th Avenue South and Dearborn Street.

Commercial Solvents Company, manufacturers and distributors of chemicals of various kinds, many of which are used in metallurgical processes, has removed its New York City offices to the New York Central Building, 230 Park Avenue, from the former location at 17 East 42nd Street.

Precision Machinery and Foundry Company, Calgary, Alta., Can., will shortly start work on the erection of a foundry. Foundry equipment and tools will be purchased.

W. M. Miller will, at an early date, close his jewelry business in Gaffney, S. C., to become associated with the firm of **Crosby and Miller** of Greenville, manufacturing jewelers.

Albion Metal Products Company, Albion, Mich., manufacturer of spray guns, windshield screens, etc., is reported planning a one-story addition to cost over $30,000 with equipment.

W. J. Schoenberger Company, Cleveland, Ohio, has purchased the former plant of Marvel Equipment Company, Broadway and Pennsylvania R.R., to manufacture brass gas gages.

The National Bronze and Aluminum Foundry Company, Cleveland, Ohio, is building an addition to its plant, which will increase capacity about 50 per cent. J. H. Shafner is president.

Precision Grinding Wheel Company, 8300 Torresdale Avenue, Philadelphia, Pa., has awarded general contract for a two-story addition, 70 x 97 ft., to cost about $50,000 with equipment.

Bay State Abrasive Products Company, Westboro. Mass., manufacturer of grinding materials, plans a one-story plant to cost close to $40,000 with equipment. O. S. Buckman is head.

Walter Kidde Company, 60 West Street, Bloomfield, N. J., manufacturer of fire extinguishers, parts, etc., has filed plans for a one-story addition, to cost about $50,000 with equipment.

Ferrante Electric Ltd., 26 Noble Street, Toronto, Can., plans the construction of a factory for the manufacture of transformers and electrical apparatus. Estimated cost $60,000 to $100,000.

Lyon Metal Products Corporation, 337 S. Anderson Street, Los Angeles, Cal., has awarded contract for one-story storage and distributing plant, 85 x 177 ft., to cost about $27,000 with equipment.

Aluminum Smelting and Refining Company, Cleveland, Ohio, recently organized, has established a plant at 1265 East Fifty-fifth Street. J. J. Ripner is president and L. J. Kane, secretary and treasurer.

Milton Jewelry Company, Inc., and **Baer and Wilde Company, Inc.,** of Attleboro, Mass., manufacturers of Kum-a-Part Cufflinks, have leased the fifth floor in the building at No. 307 Fifth Avenue, New York.

Hadley Company, 297 Dexter Street, Providence, R. I., manufacturer of jewelry, plated ware, etc., has awarded general contract for a two-story addition, 60 x 105 ft. to cost about $50,000 with equipment.

Laher Spring Company, 167 Hayes Street, San Francisco, Cal., manufacturer of automobile springs, awarded contract for a one-story factory at 11th Street and Burnes Place. Estimated cost $40,000.

Crown Brass Manufacturing Company, which took over the Los Angeles Brass Foundry last August, has consolidated the two plants at 1535 East Sixteenth Street, and has discontinued the use of the latter name.

Eagle Bronze Works, 10 E. Bleecker Street, Mount Vernon, N. Y., soon will take bids on a general contract for an addition to cost about $45,000. The contract also includes improvements to the present plant.

Runzel Lentz Electric Manufacturing Company, 1751 North Western Avenue, Chicago, Ill., awarded contract for a 105 x 108 ft. addition to factory for the manufacture of electrical supplies. Estimated cost $35,000.

Merit Company, 2125 Rice Street, Chicago, Ill., manufacturer of metal burial caskets, is having sketches made for a three-story, 115 x 315 ft. factory at Augusta Street and Cicero Avenue. Estimated cost $350,000.

Bohn Aluminum and Brass Corporation, 2512 E. Grand Boulevard, Detroit, Mich., is erecting an addition for centralization of aluminum extrusion operations, totalling about 50,000 sq. ft. of floor space, to cost $250,000 with machinery.

E. Ingraham Company, N. Main Street, Bristol, Conn., manufacturer of clocks, clock movements, etc., will erect a one-story addition, 50 x 80 ft., to a five-story building now in course of erection, extension to be used largely as a lacquer shop.

Federal-Mogul Corporation, 11031 Shoemaker Street, Detroit, Mich., manufacturer of bearings, bushings, die-castings, etc., has awarded general contract for a one-story foundry unit for die-casting to cost more than $50,000 with equipment.

Campbell Manufacturing Company, Freehold, N. J., manufacturer of flashlights and accessories, contemplates enlargement of plant for the manufacture of other specialties and installation of additional equipment. U. W. Olsen is production manager.

Acme Aluminum Foundry Company, 814 West Seventy-fifth Street, Chicago, Ill., has increased its capital from $15,000 to $100,000. The company is considering a two-story and basement addition, 50 x 125 ft. to cost about $45,000 with equipment.

I. Fischman and Sons, Tenth Street and Allegheny Avenue, Philadelphia, Pa., manufacturers of soda fountain equipment, fixtures, etc., will begin construction of a new plant, to cost $1,400,000 with machinery. Present works will be moved to new location.

Wheeler Metal Products Corporation, recently organized to take over and expand Wheeler Radiator and Manufacturing Company, 1637 Collamer Avenue, E. Cleveland, Ohio, has arranged for the sale of stock in amount of $310,000, part of proceeds to be used for general expansion.

Guide Motor Lamp Manufacturing Company, 2130 W. 110th Street, Cleveland, Ohio, manufacturer of automobile headlights, etc., will increase capacity about 50 per cent at a cost of $225,000, including equipment. The company is a division of General Motors Corporation, Detroit.

Art Metal Construction Company, Jamestown, N. Y., manufacturer of steel and bronze interior equipment, metal furniture, etc., has leased four floors in building 17, at terminal warehouse group, Twenty-seventh Street and Eleventh Avenue, New York, for metropolitan branch and distributing plant.

Glidden Company, Madison Avenue, N.W., Cleveland, Ohio, has acquired the plant and business of the Metals Refining Company, Hammond, Ind., and will operate as a subsidiary. An expansion program has been authorized, to include extensions in Hammond plant and installation of additional machinery.

H. M. Johnquest, general analytical chemist and specialist in electrodeposition and other factory problems, has removed to larger quarters at 480 Watertown Avenue, Waterbury, Conn., from his former location at 42 Bank Street. A complete analytical laboratory is maintained and the new quarters will provide space for rapidly expanding activities.

Crown Cork and Seal Company, Inc., 1511 Guilford Avenue, Baltimore, Md., manufacturer of metal bottle caps and capping machinery, is said to be arranging for expansion to cost more than $1,000,000, including installation of machinery in buildings now under construction and additional units. Charles E. McManus is president.

Allied Die Casting Corporation, Long Island City, N. Y., has taken a twenty-one year lease on a pro-

posed four-story concrete factory, to be erected on a 100 x 180 ft. site extending from the northeast corner of Forty-third Avenue and Thirty-eighth Street to Thirty-ninth Street. The proposed building will cost approximately $400,000 and will contain 75,000 square feet.

Robbins and Myers, Inc., successors to the Robbins and Myers Company, Springfield, Ohio, manufacturers of electric motors, generators and fans, have established a district sales branch in Atlanta to handle the company's trade in the group of southeastern states. A warehouse will also be opened in Atlanta. Carl V. Malone has been named manager of the branch.

The Fisher Brass Company, Marysville, Ohio, has awarded contract for the erection of a two-story cement block building, 18 x 60, as another unit of the company's plant here. The new building will be used for the office and the shipping department. A new 40 x 80 shipping department building is now being erected at Bellfontaine plant and a 60 x 100 foundry building has just been completed at the Delaware plant of the company.

The Pangborn Corporation, Hagerstown, Md., has taken over the goodwill, patterns, records and drawings of the Universal Shot and Sand Blast Manufacturing Company of Hoboken, N. J. Universal equipment, parts and supplies will now be manufactured by the Pangborn company, which will serve all of the acquired company's customers. **Robert H. Donnelly** and **Frank C. Weber,** former owners of the Universal firm, are now associated with the Pangborn Corporation.

The Roessler and Hasslacher Chemical Company, manufacturers and importers of chemicals for the electroplating and other industries, have removed to their new offices at 10 East 40th Street, New York City, in a building recently completed. The firm's headquarters were formerly at 709-717 Sixth Avenue. The new location is convenient to all railroad terminals and is just around the corner from the Chemists' Club. The company now has improved facilities as well as greater space for its extensive activities.

Price Brothers, Inc., and the **Atlas Bronze Manufacturing Company,** manufacturers and distributors of bronze tablets, signs, plaques, memorials, cast bronze specialties, illuminated directional signs and other products, announce that they have outgrown their old quarters at 412-420 Orleans Street, Chicago, Ill., and expect to be in their new plant at Maplewood and Schubert Avenues, Chicago, about April 15. The companies will continue to maintain general offices and sales rooms at 333 North Michigan Avenue, Chicago.

Lasalco, Inc., St. Louis, Mo., manufacturers of plating and polishing equipment and supplies, have awarded contracts for the construction of an addition to their plant. This new unit will be 60 by 120 feet in area and the additional space will be used for the manufacture of Richards plating barrels, one of the best known products of the company. The firm states that the rapid expansion in the use of the equipment has forced the present plant beyond its capacity, making additional space necessary.

Aluminum Industries, Inc., Cincinnati, Ohio, manufacturer of aluminum alloy pistons, have purchased **Diamond Motor Parts Company,** St. Cloud, Minn., maker of replacement parts for automotive industry, which has been operated under receivership for several months. The products of the St. Cloud company will be marketed under the name of Permit-Diamond through Detroit office of the Aluminum company. F. J. Glennon, vice-president and sales manager of Aluminum Industries will be general sales manager. The products of Diamond company include piston rings, pins; cast iron and steel valves; spring and tie rod bolts; bronze and steel bushings; impellers and other pump parts.

R. W. Shore and **L. S. Love,** for many years identified with the machine tool trade in New York, and **J. G. Sparks,** recently manager of the **Waverly Musical Products Company,** Long Island City, N. Y., have formed a new company—**Pressed Products, Inc.,** which has leased manufacturing space at 36-20 Thirty-fourth Street, Long Island City, and will engage in metal stampings work on contract. Mr. Sparks is president of the new company. Mr. Shore is vice-president, and Mr. Love is secretary-treasurer. The company will specialize in light and medium stampings in brass and steel, having a range of presses with capacities up to 70 tons. Funk and Shore, 50 Church Street, New York, are selling agents.

Jonathan Bartley Crucible Company, Trenton, N. J., has changed its firm name to the Bartley Crucible and Refractories Company. This change was made because of the increased growth of the refractory business of this company, consisting of the manufacture of refractories for high temperature and severe conditions. There is absolutely no truth in the rumor that has been circulated that they are retiring entirely from the crucible manufacturing business. Lewis H. Lawton, president, has purchased the majority of the stock of the company, the former board of directors having been retired and an entirely new board elected. Many new improvements have been made in plant equipment and methods. They have been experimenting with the manufacture of a new crucible to meet the present day melting conditions. These experiments have been highly successful and the company is now producing a crucible which gives an unusually fine service under severe tests.

New Companies

Smason Brass Products Company, care of J. F. Carroll, 51 Chambers Street, New York, has been incorporated with capital of $30,000.

Joseph Marisco and Son, Inc., West Broadway and Matlock, Paterson, N. J., has been incorporated and will fabricate copper, brass, and Monel products.

Paragon Die Casting Company, 3225 Ravenswood Avenue, Chicago, Ill., has been incorporated with $50,000 capital by Frank Lannert, R. J. Scott, and Joseph Huska.

Alco Brass Foundry, Inc., 5811 Wilmington Avenue, Los Angeles, Cal., has been incorporated with $10,000 capital by Allen and Sara Cohn, George W. and Earl C. Heiser.

Malden Bronze Foundries, Inc., Boston, Mass., has been incorporated with 5000 shares no par value stock to manufacture statuary, ornamental bronze, etc., by Charles V. S. Paul, 722 Commonwealth Avenue.

Michigan Valve and Foundry Company, 3631 Parkinson Avenue, Detroit, Mich., has been incorporated by Willard F. Rockwell, with 5000 shares no par value stock to engage in a general foundry and metal manufacturing business.

Bancroft Pressed Metal Company, Worcester, Mass., has been incorporated to carry on the business of brass, aluminum and steel stampings. Capital $50,000; incorporators, Mark Baker, J. H. McElroy and B. Larz Newton, all of Worcester.

Manufacturers Finishing Company, Waterbury, Conn.; has been incorporated, to engage in electroplating, japanning, buffing, polishing and the like, and also the manufacture of brass, copper and steel articles. The incorporators are J. F. O'Neill, E. V. O'Neill and R. C. Frost.

Metal Textile Corporation, recently organized with capital of 245,000 shares of stock to take over the company of the same name with a plant at 4 Central Avenue, W. Orange, N. J., manufacturer of kitchen utensil metallic cleaning devices, is disposing of stock issue to total $980,000, part of proceeds to be used for expansion.

Los Angeles Valve and Manufacturing Company, 1650 N. Indiana Street, Los Angeles, Cal., has been incorporated with $250,000 capital by A. W. Warr, B. F. Miller, Jr., J. B. Roof and E. M. Buckius, all of Los Angeles, to succeed the Los Angeles Valve and Fittings Company. It is understood that the new company contemplates an expansion of the scope of its business.

Kay Jewelry Company, Waterbury, Conn., has been incorporated to carry on the business of manufacturing, exporting, importing jewelry, watches and silverware. The amount of authorized capital stock is $60,000, divided into 600 shares of the par value of $100 each, paid in $60,000. The incorporators are S. P. Waskowitz, and Benjamin B. Golding, both of W. Hartford, and E. S. Pomeranz of Hartford.

Newark Galvanizing Company, 39 Verona Avenue, Newark, N. J., has just opened a plant at that address for hot dip galvanizing exclusively, according to an announcement by Frank C. Zuch, president. The plant is now in production operation, and is stated to be equipped with modern mechanical apparatus for handling work of all sizes in any quantity. The company is a direct subsidiary of the **Atlas Fence Company.** The new works is located conveniently and can handle carload lots directly from the cars, which can be taken in on the company's private tracks. The plant is managed by **Theodore Hayes,** formerly connected with the **Staten Island Shipbuilding Company,** Mariners Harbor, New York. When that company merged with another shipbuilding firm, the Newark Galvanizing Company was formed and took over nearly the entire galvanizing force that had been employed by the shipyard.

Trade Publications

Multiple Retort Underfeed Stoker. Combustion Engineering Corporation, New York City.

Bristol's Automatic Electric Control Valves. The Bristol Company, Waterbury, Conn. Motor and magnet operated types are described.

Ajax-Northrup Electric Furnaces. The Ajax Electrothermic Corporation, Trenton, N. J. Bulletin 4a, showing metal melting methods.

The American Sand Blast Room. The American Foundry Equipment Company, Mishawaka, Ind. Pamphlet describing the ventilating hopper type of equipment.

High Speed Snagging Equipment. Norton Company, Worcester, Mass. Illustrated pamphlet on various types of snagging machines and abrasive wheels for use with such machinery.

Finishing Research Advisory Service. Finishing Research Laboratories, Inc., 1164 West 22nd Street, Chicago, Ill. Pamphlet describing the services offered and advantages to be derived therefrom.

Good for 41 years. E. Reed Burns Manufacturing Corporation, Brooklyn, N. Y. Leaflet on the history and activities of the company, which manufactures polishing and buffing supplies of all types.

Black and White. E. F. Houghton and Company, Philadelphia, Pa. The March issue of the company's publication, containing "Psychology Goes to Work," an interesting article by Dr. Donald A. Laird, industrial psychologist.

Man's Conquest of the Air. Midwest Air Filters, Inc., Bradford, Pa. A booklet by Stig G. Sylvan, research engineer of the company, and Prof. Samuel E. Dibble, Carnegie Institute of Technology. Interesting and important technical data on air cleaning.

Mond Nickel Bulletin. American Mond Nickel Company, Pittsburg, Pa. February issue of the company's publication. A summary of current information on nickel. Contains an interesting article on The Electrodeposition of Nickel, outlining recent notable advances in this art.

Coming-of-Age Celebrations. The Institute of Metals, 36 Victoria Street, Westminster, London, England. A booklet on the recent event which took place in London on the completion of the British Institute's twenty-first year of activity.

Magnetic Separation Equipment. Magnetic Manufacturing Company, Milwaukee, Wis. Bulletin 80, on equipment for concentration of ores and minerals, together with theoretical and practical data gained during thirty years of study in this field.

Production Plating—the Globe Way. The Globe Rustproofing Company, 1259 West 78th Street, Cleveland, Ohio. Very interesting illustrated pamphlet describing a large plating and rustproofing concern and outlining its various services and the processes used. Some very fine advertisements used in the past by the company are reproduced.

General Electric Company, Schenectady, N. Y. Publications: Helicoil Sheath-Wire Resistor Units; Adjustable-varying-speed Motors; Electric Heating Equipment for Hot Galvanizing Tanks; Insulating Material for Railway and Industrial Haulage Apparatus.

Protest Against Public Utility Monopoly Competition in Electric and Gas Appliances. Merchant and Evans Company, 2035 Washington Avenue, Philadelphia, Pa. Booklet based on a complaint before the Federal Trade Commission and addressed especially to non-public utility manufacturers, distributors and dealers.

Five-Point Wurtzilite Paints, Coatings and Binders. American Wurtzilite Company, Builders Building, Chicago, Ill. A pamphlet describing Wurtzilite, a protective coating material said to be waterproof, acid and alkali proof, heat resisting, dielectric and adhesive. Among its uses are listed coatings for tanks and containers which need to be acid or alkali proof, on wood, metals, rubber, cement and other materials, in the frustration of electrolysis that causes corrosion, etc.

Metal Prices, April 21, 1929

NEW METALS

Copper: Lake, 18.25. Electrolytic, 18.00. Casting, 17.625.
Zinc: Prime Western, 6.55. Brass Special, 6.80.
Tin: Straits, 44.50. Pig, 99%, 43.625.
Lead: 6.85. **Aluminum**, 24.30. **Antimony**, 9.875.

Nickel: Ingot, 35. Shot, 36. Elec. 35. Pellets, 40.
Quicksilver: flask, 75 lbs., $123. **Bismuth**, $1.70.
Cadmium, 95. **Cobalt**, 97%, $2.60. **Silver**, oz., Troy, 55.50.
Gold: oz., Troy, $20.67. **Platinum**, oz., Troy, $66.50.

INGOT METALS AND ALLOYS

Brass Ingots, Yellow	13½
Brass Ingots, Red	16
Bronze Ingots	17¼
Casting Aluminum Alloys	21 to24
Manganese Bronze Castings	28 to40
Manganese Bronze Ingots	19 to21
Manganese Bronze Forgings	36 to44
Manganese Copper, 30%	30 to40
Monel Metal Shot	28
Monel Metal Blocks	28
Parsons Manganese Bronze Ingots	16½to19¾
Phosphor Bronze	19 to22
Phosphor Copper, guaranteed 15%	26½to28
Phosphor Copper, guaranteed 10%	25½to27
Phosphor Tin, no guarantee	55 to70
Silicon Copper, 10%......according to quantity	30 to35

OLD METALS

Buying Prices		Selling Prices
16½to16¾	Heavy Cut Copper	17½to17¾
14½to14¾	Copper Wire, mixed	15½to15¾
11¾to12	Light Copper	12¾to13
13 to13¼	Heavy Machine Composition	14 to14¼
9 to 9½	Heavy Brass	10 to10½
7 to 7½	Light Brass	8 to 8½
9¾to10¼	No. 1 Yellow Brass Turnings	10¾to11¼
12¼to12½	No. 1 Composition Turnings	13¼to13½
5¼to 5½	Heavy Lead	6 to 6½
3½to 3¾	Zinc Scrap	4¾to 5¼
8 to10	Scrap Aluminum Turnings	12½to14¼
13 to13½	Scrap Aluminum, cast alloyed	17½to18½
19 to20	Scrap Aluminum sheet (new)	22 to22½
30½to32	No. 1 Pewter	35 to38
20 to21	Old Nickel Anodes	22 to23
20 to23	Old Nickel	22 to25

Wrought Metals and Alloys

COPPER SHEET

Mill shipment (hot rolled)	27¾ to 28¾c. net base
From Stock	28¾ to 29¾c. net base

BARE COPPER WIRE

19⅝c. to 19⅞c. net base, in carload lots.

COPPER SEAMLESS TUBING

29¼c. to 30¼c. net base.

SOLDERING COPPERS

300 lbs. and over in one order	26¼c. net base
100 lbs. to 200 lbs. in one order	26¾c. net base

ZINC SHEET

Duty sheet, 2c. per lb.	Cents per lb.
Carload lots, standard sizes and gauges, at mill, less 7 per cent discount	10.25 net base
Casks, jobbers' price	10.50-10.75 net base
Open Casks, jobbers' price	11.00-11.75 net base

ALUMINUM SHEET AND COIL

Aluminum sheet, 18 ga., base, ton lots, per lb.	33.30
Aluminum coils, 24 ga., base, price	31.00

ROLLED NICKEL SHEET AND ROD

Net Base Prices

Cold Drawn Rods	53c.	Cold Rolled Sheet	60c.
Hot Rolled Rods	45c.	Full Finished Sheet	52c.

BLOCK TIN SHEET

Block Tin Sheet—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 10½c. over Pig Tin; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 17c. over; less than 25 lbs., 25c. over.

SILVER SHEET

Rolled sterling silver 57c. to 59c. per ounce, Troy.

BRASS MATERIAL—MILL SHIPMENTS

In effect April 19, 1929
To customers who buy 5,000 lbs. or more in one order.

	Net base per lb.		
	High Brass	Low Brass	Bronze
Sheet	$0.23¼	$0.25	$0.26¼
Wire	.23¾	.25½	.26¾
Rod	.21¼	.25¾	.27
Brazed tubing	.30⅞	....	.35⅞
Open seam tubing	.31¼	....	.34¼
Angles and channels	.31¼	....	.34¼

BRASS SEAMLESS TUBING

28¼c. to 29¼c. net base.

TOBIN BRONZE AND MUNTZ METAL

Tobin Bronze Rod	.25¾c. net base
Muntz or Yellow Metal Sheathing (14"x48")	.24c. net base
Muntz or Yellow Rectangular sheet other Sheathing	.25c. net base
Muntz or Yellow Metal Rod	.22¼c. net base

Above are for 100 lbs. or more in one order.

NICKEL SILVER (NICKELENE)

Net Base Prices

Grade "A" Sheet Metal		Wire and Rod	
10% Quality	31⅜c.	10% Quality	34⅛c.
15% Quality	33c.	15% Quality	37¾c.
18% Quality	34¼c.	18% Quality	41c.

MONEL METAL SHEET AND ROD

Hot Rolled Rods (base)	35	Full Finished Sheets (base)	42
Cold Drawn Rods (base)	40	Cold Rolled Sheets (base)	50

BRITANNIA METAL SHEET

No. 1 Britannia—18" wide or less, No. 26 B. & S. Gauge or thicker, 500 lbs. or over, 8c. over N. Y. tin. price; 100 lbs. to 500 lbs., 10c. over; 50 to 100 lbs., 15c. over; 25 to 50 lbs., 20c. over; less than 25 lbs., 25c. over. Prices f. o. b. mill.

Supply Prices, April 22, 1929

ANODES

Copper: Cast		Quotations uncertain, due to rapid fluctuation of copper prices.
Rolled, oval		
Rolled, sheets, trimmed		
Brass: Cast		
Zinc: Cast	12½c. per lb.	

Nickel: 90-92%		45c. per lb.
95-97%		47c. per lb.
99%		49c. per lb.

Silver: Rolled silver anodes .999 fine are quoted from 58⅞ to 60⅞c., Troy ounce, depending upon quantity.

FELT POLISHING WHEELS WHITE SPANISH

Diameter	Thickness	Under 100 lbs.	100 to 200 lbs.	Over 200 lbs.
10-12-14 & 16″	1″ to 3″	$3.00/lb.	$2.75/lb.	$2.65/lb.
6-8 & over 16	1 to 3	3.10	2.85	2.75
6 to 24	Under ½	4.25	4.00	3.90
6 to 24	½ to 1	4.00	3.75	3.65
6 to 24	Over 3	3.40	3.15	3.05
4 up to 6	¼ to 3	4.85	4.85	4.85
4 up to 6	Over 3	5.25	5.25	5.25
Under 4	¼ to 3	5.45	5.45	5.45
Under 4	Over 3	5.85	5.85	5.85

Grey Mexican Wheel deduct 10c per lb. from White Spanish prices

COTTON BUFFS

Full Disc Open buffs, per 100 sections.

12″ 20 ply 64/68 Unbleached	$28.10
14″ 20 ply 64/68 Unbleached	37.15
12″ 20 ply 80/92 Unbleached	31.50
14″ 20 ply 80/92 Unbleached	42.85
12″ 20 ply 84/92 Unbleached	40.80
14″ 20 ply 84/92 Unbleached	54.60
12″ 20 ply 80/84 Unbleached	37.40
14″ 20 ply 80/84 Unbleached	50.45
Sewed Pieced Buffs, per lb., bleached	40c to 73c

CHEMICALS

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone	lb.	.14-.19
Acid—Boric (Boracic) Crystals	lb.	.08½
Chromic 100 and 400 lb. drums	lb.	.20½-.21
Hydrochloric (Muriatic) Tech., 20°, Carboys	lb.	.02
Hydrochloric, C. P., 20 deg., carboys	lb.	.06
Hydrofluoric, 30% bbls.	lb.	.08
Nitric, 36 deg., carboys	lb.	.06
Nitric, 42 deg., carboys	lb.	.07
Sulphuric, 66 deg., carboys	lb.	.02
Alcohol—Butyl	lb.	.17¼-.21¾
Denatured, drums	gal.	.48-56
Alum—Lump, Barrels	lb.	.03¼
Powdered, Barrels	lb.	.039
Aluminum sulphate, commercial tech	lb.	3.3
Aluminum chloride solution in carboys	lb.	.06½
Ammonium—Sulphate, tech., bbls.	lb.	3.3
Sulphocyanide	lb.	.65
Arsenic, white, kegs	lb.	.05
Asphaltum	lb.	.35
Benzol, pure	gal.	.60
Borax Crystals (Sodium Biborate), bbls	lb.	.04½
Calcium Carbonate (Precipitated Chalk)	lb.	.04
Carbon Bisulphide, Drums	lb.	.06
Chrome Green, bbls.	lb.	.28
Chromic Sulphate	lb.	.37
Copper—Acetate (Verdigris)	lb.	.23
Carbonate, bbls.	lb.	.19
Cyanide (100 lb. kegs)	lb.	.50
Sulphate, bbls.	lb.	7.2
Cream of Tartar Crystals (Potassium Bitartrate)	lb.	.27
Crocus	lb.	.15
Dextrin	lb.	.05-.08
Emery Flour	lb.	.06
Flint, powdered	ton	$30.00
Fluor-spar (Calcic fluoride)	ton	$70.00
Fusel Oil	gal.	$4.45
Gold Chloride	oz.	$14.00
Gum—Sandarac	lb.	.26
Shellac	lb.	.59-.61
Iron Sulphate (Copperas), bbl.	lb.	.01½
Lead Acetate (Sugar of Lead)	lb.	.13¼
Yellow Oxide (Litharge)	lb.	.12½
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Nickel—Carbonate, dry, bbls.	lb.	.30
Chloride, bbls.	lb.	.18
Salts, single, 300 lb. bbls.	lb.	.13
Salts, double, 425 lb. bbls.	lb.	.13
Paraffin	lb.	.05-.06
Phosphorus—Duty free, according to quantity	lb.	.35-.40
Potash, Caustic Electrolytic 88-92% broken, drums	lb.	.09
Potassium Bichromate, casks (crystals)	lb.	.09¼
Carbonate, 96-98%	lb.	.07
Cyanide, 165 lb. cases, 94-96%	lb.	.57½
Pumice, ground, bbls.	lb.	.02½
Quartz, powdered	ton	$30.00
Rosin, bbls.	lb.	.04½
Rouge, nickel, 100 lb. lots	lb.	.25
Silver and Gold	lb.	.65
Sal Ammoniac (Ammonium Chloride) in casks	lb.	.05½
Silver Chloride, dry, 100 oz. lots	oz.	.46½
Cyanide (fluctuating)	oz.	.57-.60
Nitrate, 100 ounce lots	oz.	.40
Soda Ash, 58%, bbls.	lb.	.02½
Sodium—Cyanide, 96 to 98%, 100 lbs.	lb.	.18
Hyposulphite, kegs	lb.	.04
Nitrate, tech., bbls	lb.	.04¾
Phosphate, tech., bbls.	lb.	.03¾
Silicate (Water Glass), bbls.	lb.	.02
Sulpho Cyanide	lb.	.32½
Sulphur (Brimstone), bbls.	lb.	.02
Tin Chloride, 100 lb. kegs	lb.	.37
Tripoli, Powdered	lb.	.03
Wax—Bees, white, ref. bleached	lb.	.60
Yellow, No. 1	lb.	.45
Whiting, Bolted	lb.	.02½-.06
Zinc Carbonate, bbls.	lb.	.11
Chloride, casks	lb.	.06¾
Cyanide (100 lb. kegs)	lb.	.41
Sulphate, bbls.	lb.	.03¾